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FOREWORD

The *United States Armed Forces Medical Journal* is the medium for disseminating information of administrative and professional interest to all medical personnel of the Department of Defense. The Chairman of the Armed Forces Medical Policy Council and the Surgeons General of the several services invite all medical officers, dental officers, Medical Service Corps officers, Nurse Corps officers, and officers of the Veterinary Corps of the Armed Forces, and the medical consultants of the Army, Navy, and Air Force to submit manuscripts for publication in this *Journal.*

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Monthly Message

The practice of medicine is a confluence fashioned by the delicate blending of two basic ingredients, both essential to the success of the healing profession. One, the *science* of medicine, is that ever-growing, broad stream of accumulated facts, each of whose tributaries, large or small, has added to the total sum of medical achievement. Such contributions live on after the passing of the donor and serve as the foundation for research by successive generations of scientists. The second fraction of the whole is the *art* of medicine which might be described as the patient-physician relationship which plays so important a role in the successful application of scientific therapy. Unlike the first ingredient, the *art* of medicine cannot be handed down from generation to generation, but must be learned anew by each neophyte. Just as the strokes of the master artist bringing life to a canvas are lost when the hand becomes lifeless, so the art of medicine is enfolded in the shrouds of the deceased physician.

With the unprecedented progress in the science of medicine during the past half century and the resultant rise of specialization with its fragmentation of the human body into structural or functional systems, the physician has tended to lose sight of his patient as a whole, integrated unit and has thought rather in terms of disease entities or complexes. It is true that mortality and morbidity rates have fallen to an all-time low due to advances in the technics of medical procedures and the discovery of medications which have virtually controlled the bacterial infections. Nevertheless, we must give care lest we lose our proficiency in the art of medicine. Therapy dispensed with the personal warmth of close understanding and mutual respect is far more effective than the cold impersonality of an automatic medical vending machine. The truly great physician is one who blends into the practice of medicine the proper proportions of science and art so that the most modern technics are applied to the patient in a vehicle leavened with the milk of human kindness.

Melvin A. Casberg

Melvin A. Casberg, *M. D., Chairman*
Armed Forces Medical Policy Council
Office of the Secretary of Defense

A New Local Treatment of Burns

Daniel S. J. Choy, *Captain, U. S. A. F. (MC)* (1)

Wallace E. Wendt, *Captain, U. S. A. F. (VC)* (1)

PRESENT-day warfare, especially bombardment with nuclear reactors, brings with it the threat of hundreds of thousands of burn casualties produced within a moment. Pearse and Payne (2) estimate that from 65 to 85 percent of all casualties resulting from an atomic explosion will have thermal injuries. The need for a revision of traditional methods of burn therapy is evident. Research into this problem has been directed toward the development of plasma expanders and the development of new technics of local therapy.

Nearly all of the technics of local burn therapy today are variations of the classical ointment-gauze pressure dressing. The disadvantages of this method and its modifications are: (1) the dressings are bulky and require much storage space; (2) they require periodic resterilization; (3) their application requires a fairly high level of training, and is time-consuming; (4) the dressings are poorly adapted to some parts of the body; (5) around limbs they may produce a tourniquet effect, leading to stasis, phlebothrombosis, and tissue anoxia; (6) around the thorax or abdomen they restrict respiration; (7) massive pressure dressings in hot weather have been observed to result in elevation of body temperature and discomfort; and (8) inspection of the lesion is not possible without removal of the dressing. It is only fair to state that the hydrolyzed casein gel dressing of Curtis et al. (3) has been used with success on 22 patients by Spangler (4).

The open-air method dispenses with the logistical problems posed by the pressure bandage technic, but its inherent limitations are (1)

---

(1) Aero Medical Laboratory, Wright-Patterson Air Force Base, Ohio.

(2) Pearse, H. E., and Payne, J. T.: Medical progress; mechanical and thermal injury from atomic bomb. New England J. Med. 241: 647-653, Oct. 27, 1949.

(3) Curtis, R. M.; Brewer, J. H.; and Rose, I. W., Jr.: New technique for local treatment of burns. J. A. M. A. 147: 741-743, Oct. 20, 1951.

(4) Spangler, P. E.: New local treatment for burns. U. S. Armed Forces M. J. 3: 105-114, Jan. 1952.

its inapplicability to circumferential burns; (2) the unrestricted local loss of tissue fluids; (3) swelling; (4) the great nursing load during the drying-out period; and (5) the difficulties of transporting the patient.

Against this background, we envisaged an occlusive type of dressing which could be sprayed on over a burn by relatively untrained personnel in minimal time. The dressing would seal contaminants out and vital fluids and electrolytes in. We thought that a nontoxic, biologically and chemically inert, adhesive, elastic, transparent, rapidly drying, film-forming, and peelable plastic, dispensed from an aerosol bomb or spray gun, would best meet this requirement and overcome most of the difficulties enumerated for standard burn dressings. Of a number of plastics tested in the laboratory, a modified polyvinyl chloride acetate copolymer in ethyl acetate solvent (XC7-9C) *(5)* was selected for evaluation as a plastic dressing to be sprayed on experimental animals.

METHOD

Laboratory. Preliminary studies included tests for permeability to bacteria and bacteriostatic properties and gross qualitative tests for adhesiveness to skin, elasticity, water resistance, flexibility, and permeability to water vapor.

"Gloves" of transparent plastic film averaging 2 to 3 mil. in thickness were applied to the (unburned) digits and hands of several subjects by immersion or spraying. The subjects were then instructed to go about their daily affairs without favoring the gloved digit or hand. Inspection of the glove was made 24 hours later. In all cases, the gloves were found to be adherent, except at the edges; sufficiently elastic and flexible after 24 hours to permit maximum flexion and extension of a digit without cracking; waterproof; and sufficiently permeable to the diffusion of water vapor so that no "water blisters" formed from trapped perspiration. The plastic peeled off easily, exposing skin that was not puckered or wrinkled. There were no complaints of subjective discomfort.

Bacteriologic studies indicated that films 2 to 3 mil. thick were impermeable to motile coliform group organisms, and when sprayed on to seeded agar plates, possessed a moderate bacteriostatic effect (fig. 1).

Clinical. Chester-White, weaned, healthy male and female hogs, from 6 to 8 weeks old, weighing from 15 to 20 kg. were used because of the histologic similarity between hog and human skin *(6)*. Barbiturate anesthesia was given through an ear vein. Complete blood

(5) Prepared by Protective Treatments, Inc., Dayton, Ohio.

(6) Moritz, A. R., and Henriques, F. C., Jr.: Studies on thermal injury; relative importance of time and surface temperature in causation of cutaneous burns. Am. J. Path. 23: 695-720, Sept. 1947.

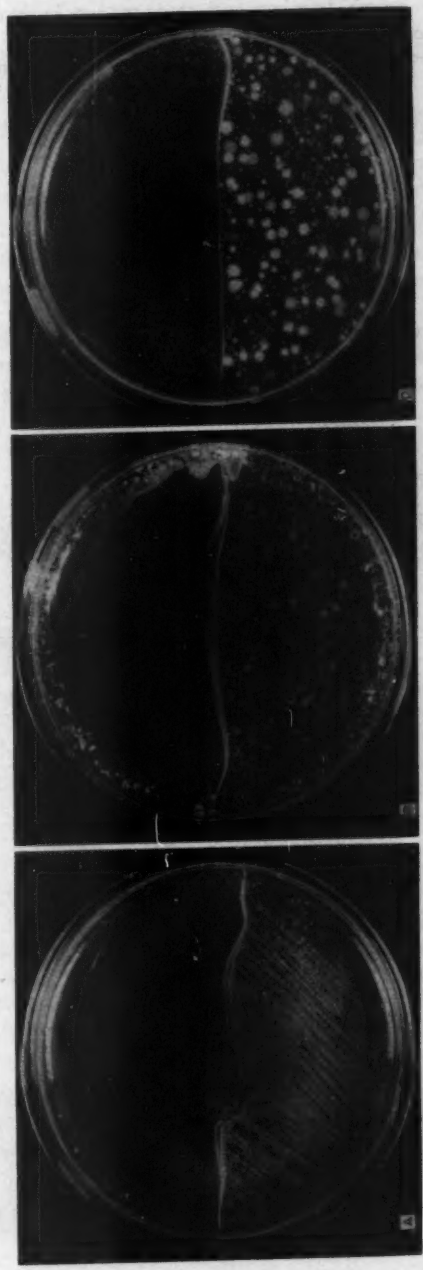

Figure 1. An agar plate (A) *streaked with* Staphylococcus aureus, (B) *seeded with* Pseudomonas aeruginosa, (C) *seeded with an aerobic spore former and* Proteus vulgaris. *Plastic film was sprayed on top half of plate* A *within 2 hours and on plates* B *and* C *after 24 hours' incubation. Note inhibition of growth on top half of all plates 24 hours later.*

counts were made before burning and repeated at intervals of from 2 to 7 days. Color photographs were taken immediately before and after burning, after the plastic dressing was applied, and repeated serially every 5 to 7 days. A standard burn pattern was made by cutting arbitrarily-shaped windows in a ¼-inch thick sheet of asbestos. With this shield in place, a third degree burn, involving about 20 percent of the body surface, was applied with a blow torch to the clipped dorsal surface of the animal (fig. 2). Joints and orifices were avoided. A biopsy specimen of burned skin was then taken.

The degree of burn was judged (1) clinically, to be third degree when the skin turned from a normal pink to a charred yellow and formed a rigid, depressed eschar which eventually sloughed off as re-epithelization occurred, and (2) histologically, to be third degree when there was full-thickness destruction of the epidermis and coagulation necrosis of more than the upper fourth of dermis (7).

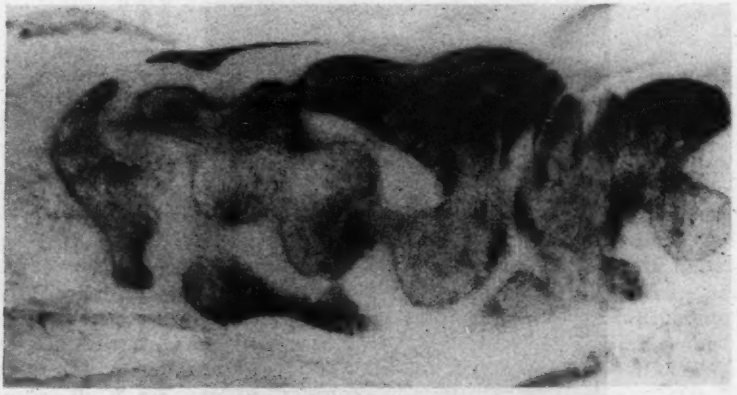

Figure 2. Pattern of burn on dorsal surface of hog.

The plastic dressing was sprayed on the burned area with an ordinary paint sprayer within 10 minutes of the burning. The ethyl acetate solvent evaporated within from 15 to 20 seconds, leaving a tough (8), elastic, and transparent plastic film 2 or 3 mil. thick adhering to the burned areas and the surrounding, healthy skin. From 150 to 300 cc. of isotonic saline solution was administered intraperitoneally to each animal.

The open-air method of therapy was employed in the control animals because it was found technically not feasible to apply and maintain the integrity of conventional pressure bandages in the ambulatory hog.

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(7) Christopher, F.: Textbook of Surgery. 3d edition. W. B. Saunders Co., Philadelphia, Pa., 1942. p. 60.

(8) The tensile strength of a 6-mil. thick film at 70° F. is 1332 p.s.i.

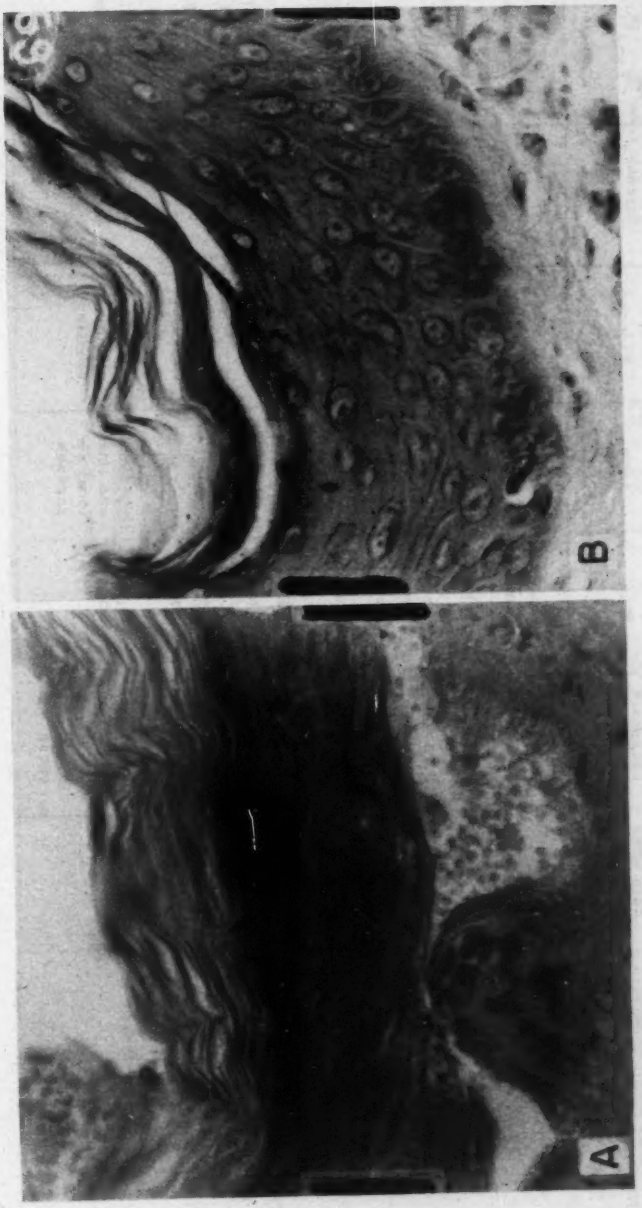


Figure 3. X 470. (A) *Third degree burn of skin. Note loss of cellular architecture of epidermal epithelium, subepidermal hemorrhage, and coagulation necrosis of dermal elements.* (B) *45 days after burn. Note essentially normal epidermal epithelium.*

TABLE 1. *Summary of findings following burns*

Hog number	Number of days required for healing*	Days after burn when autopsy was done	Diagnosis at autopsy	Skin	Liver	Kidneys	Adrenal cortex	Lung
Controls								
5	65-70 % in 28	28	Broncho-pneumonia	Ulceration, focal epi-dermization	NPC	Slight chronic pyelone-phritis	NPC	Broncho-pneumonia
6	-	8	"Burn toxemia"	Eschar formation	NPC	Cloudy swelling	Hem. zona fascic.	Hemorrhage
12	43	43	**	CR	NPC	NPC	NPC	NPC
Treated								
1	24	35	**	CR	NPC	NPC	NPC	NPC
3	28	28	**	CR	Cloudy swelling	NPC	NPC	Recent focal hemorrhage
4	37	71	**	CR	NPC	NPC	NPC	Partial atelec-tasis and ascariasis
7	85% in 28	29	Pneumonitis, bacteremia, and meta-static ab-scess	85% regen-eration	Hyperemia and small focal ab-scesses	Slight cloudy swelling	NPC	Acute inter-stitial pneu-monitis

TABLE 1. *Summary of findings following burns*—Continued

Hog number	Number of days required for healing*	Days after burn when autopsy was done	Diagnosis at autopsy	Skin	Liver	Kidneys	Adrenal cortex	Lung
Treated—Con.								
8	33	33	**	CR	NPC	Focal hydropic degeneration of the tubular epithelium	NPC	NPC
9	35	45	**	CR	NPC	NPC	NPC	NPC
10	27	31	**	CR	NPC	NPC	NPC	Partial atelectasis and ascariasis
11	-	10	Lobar pneumonia	Eschar formation	Hyperemia and focal necrosis	NPC	NPC	Acute lobar pneumonia

*Healing was complete (100%) unless lower percent is indicated.
**Animal sacrificed by exsanguination.
NPC = No pathologic change.
CR = Complete regeneration.

On recovery from anesthesia, the animals were allowed protein-supplement hog feed and fluids ad lib. All animals were ambulatory from recovery of consciousness to autopsy. When complete healing had occurred, the animals were sacrificed by exsanguination. Sections were taken of skin, heart, lungs, kidneys, liver, adrenals, and spleen for histologic study.

RESULTS

The plastic dressing was exposed to traumatic conditions which would not obtain in the case of a human being. Because of cramped quarters, the dressing was repeatedly chewed on by the hogs and abraded against the wire fence. Despite these conditions, the dressings remained intact for an average of 3 days. After 7 days, an average of 35 percent of the burned area was exposed. Healing of the burns occurred with eschar formation, sloughing, and re-epithelization with moderate cicatrix formation (fig. 3). There was a relative absence of local infection.

To date, third degree burns involving 20 percent of the body surface have been administered to 18 hogs, 4 of which were controls. This preliminary report includes only 11 of these on which complete data are available. Of the 11 being reported, 3 were controls (table 1).

Of the control group, 1 exhibited about 68 percent skin regeneration at death from bronchopneumonia 28 days after the burn. One died 8 days after burn, and had sloughing of the burn and no healing. Death was due to so-called "burn toxemia" characterized by cloudy swelling of the kidneys, and diffuse punctate hemorrhages in the adrenal cortex, pulmonary parenchyma, epicardium, and gastrointestinal tract (fig. 4). One exhibited complete regeneration of the skin after 43 days, and at autopsy no pathologic changes were noted.

Of the treated group, 1 exhibited 85 percent skin regeneration at death from pneumonitis, bacteremia, and metastatic abscesses in liver and gastrointestinal tract (fig. 5) 28 days after the burn. One died after 8 days and had sloughing of the burn and no healing. Death was due to acute lobar pneumonia and focal necrosis of the liver (fig. 6).

The remaining 6 exhibited complete regeneration of the skin with moderate cicatrix formation (fig. 7), from 24 to 37 days after the burn. Of these, 1 exhibited cloudy swelling of the liver; 1, focal hydropic degeneration of the renal tubular epithelium (fig. 8); and 2, nematode infestation of the lungs with partial atelectasis. No other pathologic findings were noted.

TOXICITY

Little or no toxicity was expected from the use of plastic XC7-9C because its base is a chemically inert vinyl resin. The properties of its solvent, ethyl acetate, are well known. In air concentrations lower than 400 p.p.m., it is nontoxic; above this level, it can produce head-

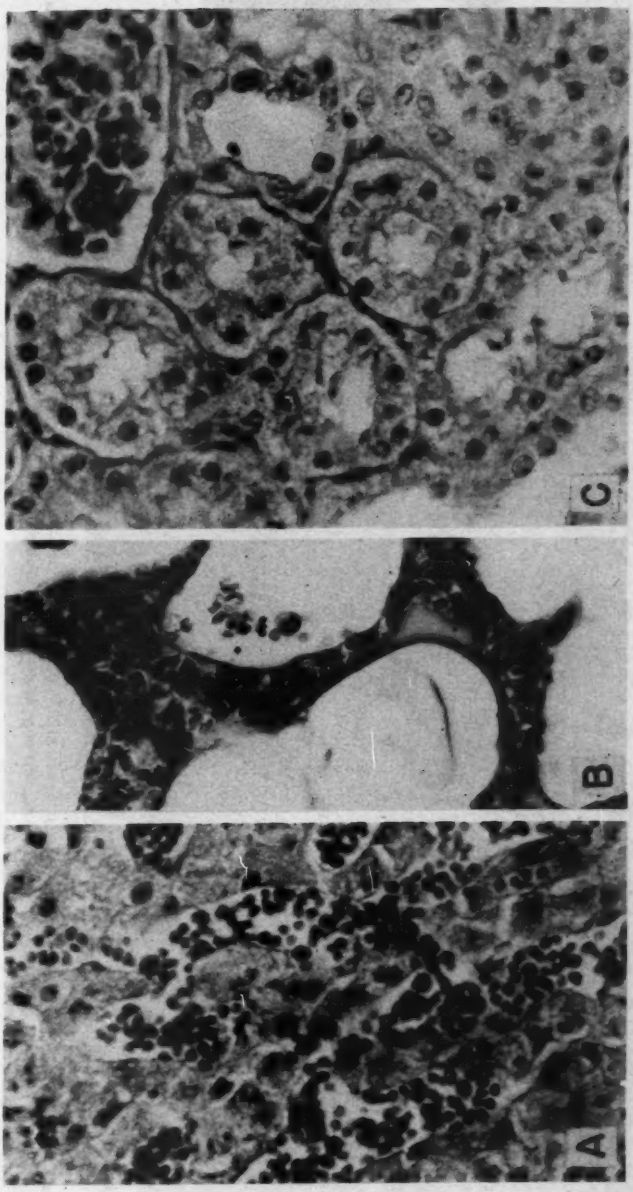


Figure 4. X 470. (A) *Section of adrenal cortex showing hemorrhages in zona fasciculata.* (B) *Section of lung showing intra-alveolar hemorrhages.* (C) *Section of kidney showing cloudy swelling.*

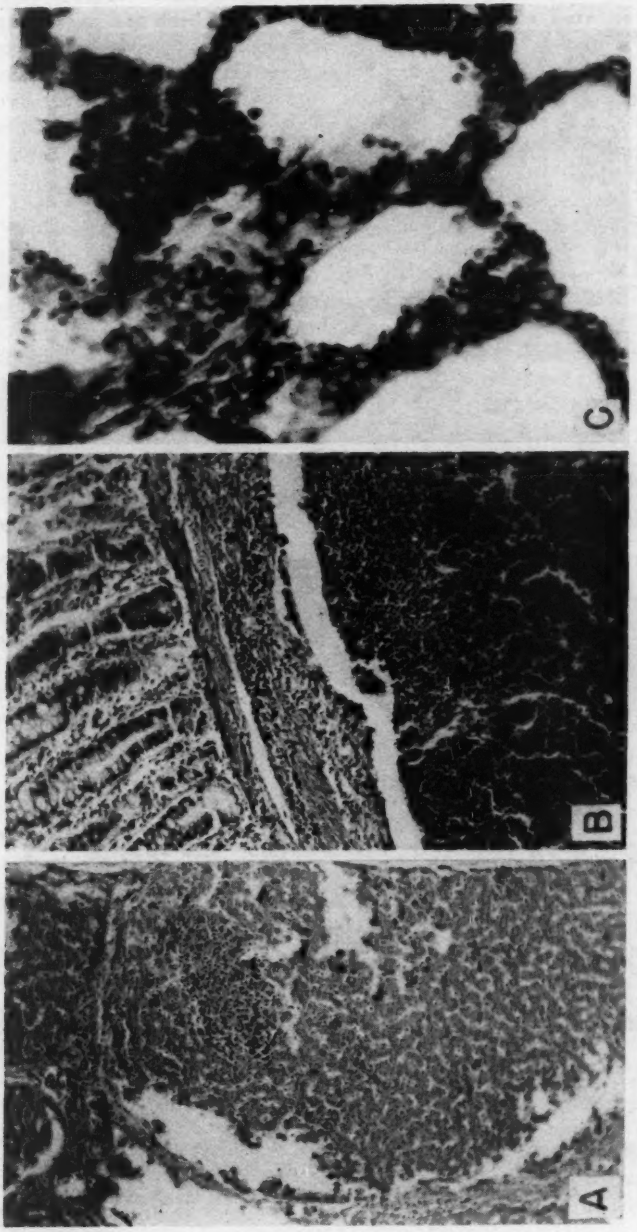


Figure 5. X 470. (A) Section of liver showing small focal abscess. (B) Section of intestine showing submucous abscess. (C) Section of lung showing acute interstitial pneumonitis.

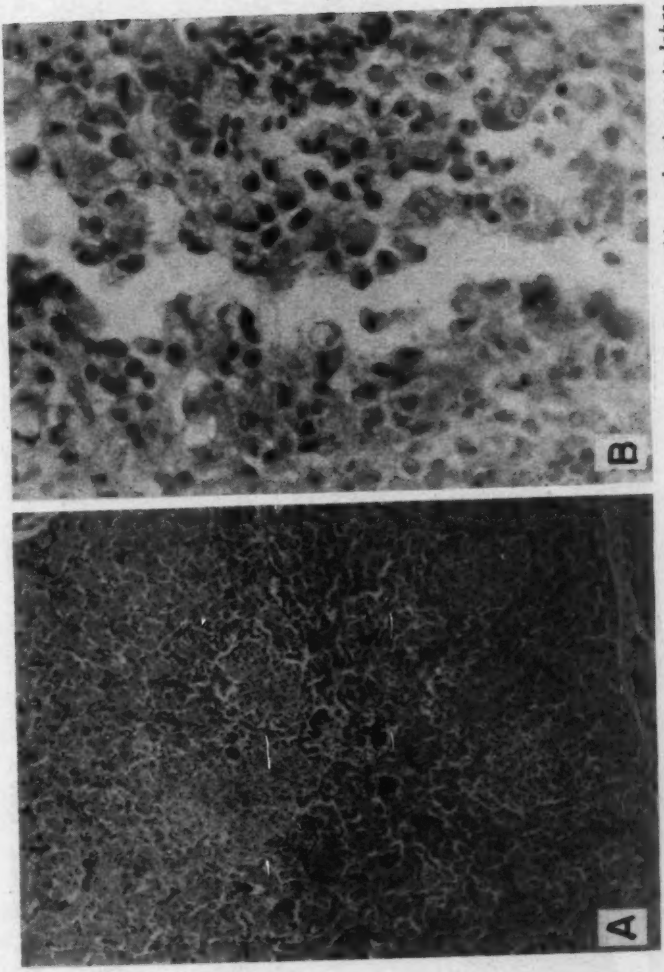
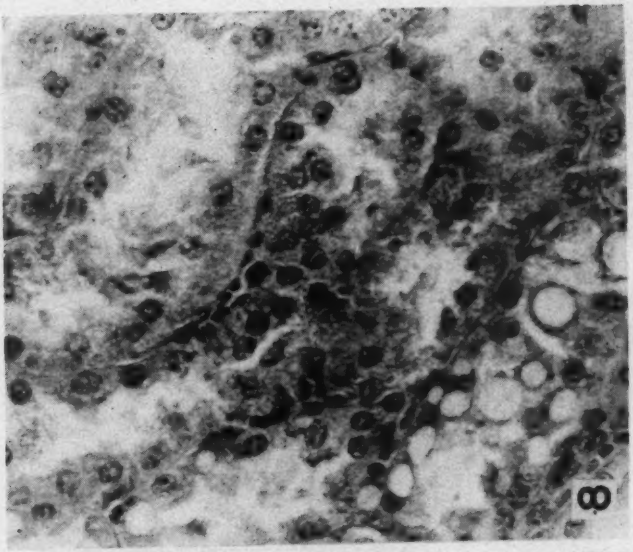


Figure 6. X 470. (A) Section of liver showing focal necrosis. (B) Section of lung showing acute lobar pneumonia.



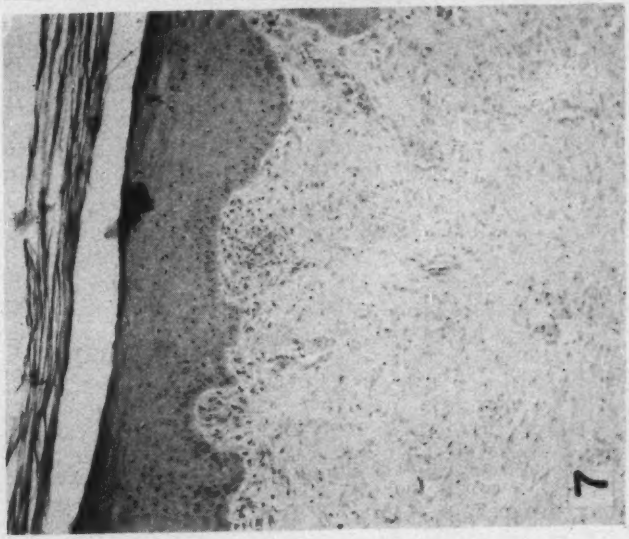


Figure 7. X 100. Section of skin, 33 days after burn, showing complete epidermal regeneration with moderate dermal cicatrix formation. Figure 8. X 470. Section of kidney showing focal hydropic degeneration of tubular epithelium.

ache and mild narcosis if inhaled, and irritation to conjunctiva, gums, and respiratory passages by contact. Chronic poisoning leads to secondary anemia, leukocytosis, and cloudy swelling and degeneration of viscera *(9)*. Because of its rapid evaporative loss, its contact time with the burn lesion is negligible; with initial dry spraying (spraying with the spray nozzle at some distance from the skin so that the initial layer is dry vinyl plastic, which forms an insulative barrier) it is possible to reduce the contact time to zero. Because it is not envisaged to apply the spray dressing more than once to each patient, the problem of chronic poisoning does not arise. The plastic is, however, inflammable, and suitable precautions should accompany its use.

Patch tests were performed to determine possible local irritant or toxic effects. The plastic was applied with an applicator to a 1 sq. cm. area on the volar surface of the shaved forearm and was covered with a band-aid. The area was inspected at 24 and 48 hours for signs of irritation. Of 1,052 subjects tested, 5 showed a ± to + reaction (doubtful to slight erythema) in 24 hours, and 3 showed a ± to + reaction in 48 hours (table 2). Those who exhibited positive reactions in 24 hours were negative in 48 hours and those who exhibited positive reactions in 48 hours had been negative at 24 hours. The total number of subjects reacting to the plastic was 8, or 0.76 percent. By contrast, it was noted with interest that about 20 percent of the group exhibited mild to severe reactions to the band-aid.

TABLE 2. *Results of patch-testing with plastic XC7-9C on 1,052 subjects.*

Reactions after	24 hr.	48 hr.
0	1,047	1,049
±	4	2
+	1	1
Percent of positive reactions*	0.48	0.29

*Including ±

Inasmuch as vinyl polymer is insoluble in tissue fluids, the question of systemic toxicity from absorption (as in the case of tannic acid *(10)*) was considered to be more hypothetical than real. Observations were, however, made of the hematologic, renal, and hepatic

(9) Sax, N. I. : Handbook of Dangerous Materials. Reinhold Publishing Corp., New York, N. Y., 1951. p. 58.

(10) Jackson, A. V.: Liver necrosis in burns treated with tannic acid. M. J. Australia 2: 352-354, Sept. 30, 1944.

systems. Serial blood counts revealed no evidence of myeloid depression and no morphologic changes of the erythrocytes such as those commonly associated with various system poisons.

Of the treated group of 8 animals, 1 had small focal abscesses, 1 had focal necrosis, and another (hog 3) had cloudy swelling of the liver (table 1). The first, however, was associated with pneumonitis and bacteremia with diffuse metastatic abscesses and the second with acute lobar pneumonia, both bearing possible etiologic relationship to the hepatic changes. The third, sacrificed by exsanguination, had no other pathologic finding.

Focal hydropic degeneration of the tubular epithelium was observed in one of the treated hogs. The significance of this and the cloudy swelling of liver in hog 3 is difficult to evaluate in the light of well-known hepatorenal changes in "burn toxemia." The evidence suggests an absence of systemic toxic effect from polyvinyl chloride acetate copolymer.

DISCUSSION

This new form of local burn therapy has these advantages: (1) a marked saving of time over conventional pressure dressings in application (fig. 9); (2) the feasibility of its use by relatively untrained personnel; (3) applicability to parts of the body poorly adapted to pressure dressings; (4) transparency allowing frequent inspection of the burned area without removal of the dressing; (5) flexibility allowing relatively unrestricted early exercise of burned hands and digits without loss of integrity of the dressing; (6) impermeability to bacteria; (7) moderate bacteriostasis; (8) reduction of local loss of electrolytes and fluids and sealing of proteolytic enzymes within the area of the burn, thus enhancing autodebridement and early sloughing of eschar in third degree burns; (9) elimination of necessity for periodic resterilization; (10) minimal storage problems; (11) the absence of tourniquet effect on limbs and restriction of respiration when applied to the abdomen or thorax; (12) portability and feasibility of use under adverse conditions in the field; and (13) adaptability to the mass therapy of burns.

These considerations are advanced with the inescapable premise in mind that adequate systemic therapy with fluid and electrolyte replacement, antibiotics, analgesics, and tetanus antitoxin, take precedence over any form of local therapy, however effective. No statistically valid conclusions can be derived from such a small series, especially with reference to relative healing times of the control and treated groups. It can only be stated that results so far are encouraging. Further evaluation of this plastic dressing on animals, with emphasis on possible toxicity, is indicated.

SUMMARY

Burn therapy technics need revision in view of the demands of atomic

warfare. A new method of local treatment of burns, using a sprayable polyvinyl plastic has been tried on 11 hogs with excellent results.

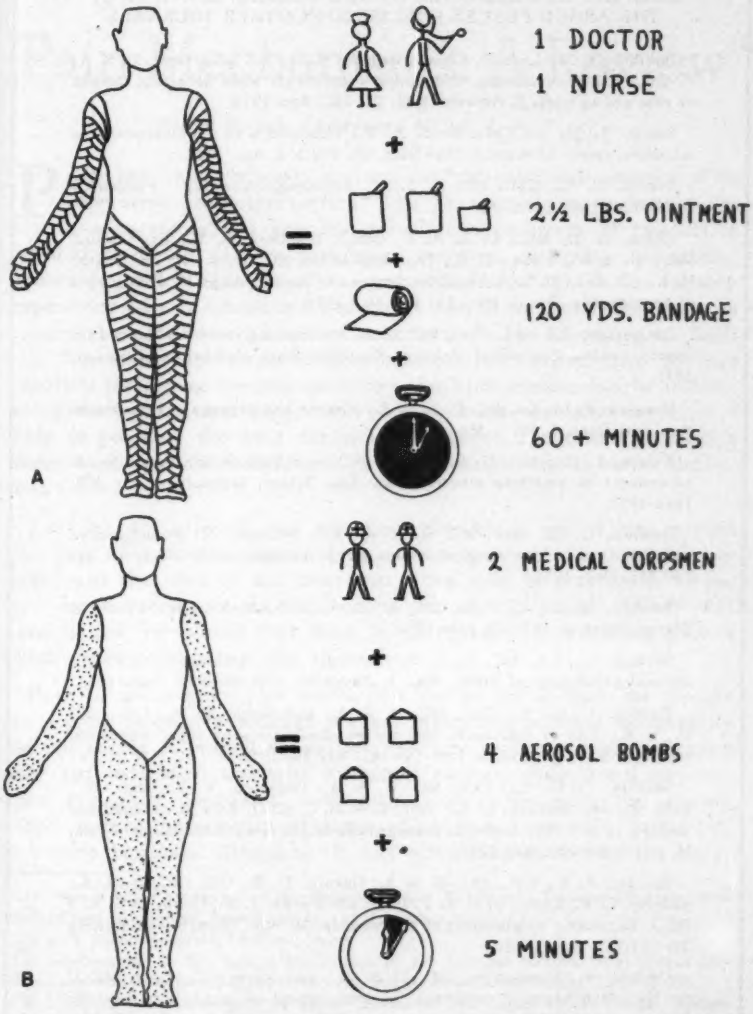


Figure 9. Comparison of treatment of 50 percent body burn by (A) *standard pressure bandage and* (B) *plastic-spray dressing. (Data was derived from tests on manikins.)*

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Pain Mechanisms: A Review[1]

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PAIN has been variously defined as "the psychical adjunct of an imperative protective reflex" (3); "a special sense having its own receptors, its specific stimuli and pathways of conduction peculiar to itself" (4); "a contingent symptom, annoying, disturbing, distressing * * * which is of no great importance" (4); or "a sensory experience that is subjective and individual, it frequently exceeds its protective function and becomes destructive" (5). According to Wolff (6), "the pain experience is first a sensation derived from noxious impulses traversing specific pathways. Such phenomena may be followed by the familiar and predictable feeling states and other reactions." This is probably the best definition we have. The future may bring about a clearer concept of the pain mechanism and a better definition.

Leriche (4) believed that too many physicians are of the opinion that pain is a defense mechanism, a warning of the presence of disease, and that this is not true; that when pain is present, it is too late for a cure; pain is the second act of a disease already well established. He stated that there is no reason for permitting pain to exist.

Pain is not a protective mechanism per se for it does not always accompany protective reflexes nor are protective reflexes necessarily the precursors of painful sensation. Reaction to pain varies with each race and individual and with emotional factors. Pain itself may become the chief complaint, supplanting the initiating factor. It may cause marked personality changes which vary from mild irritability to severe psychotic disorders. It may affect any system of the body,

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(1) From a paper presented at the Greater Boston Anesthesia Training Program, New England Medical Center, Boston, Mass., 12 November 1951.

(2) U. S. Naval Hospital, Chelsea, Mass.

(3) Sherrington, C. S.: Integrative Action of the Nervous System (Mrs. Hepsa Ely Silliman memorial lectures). Yale University Press, New Haven, Conn., 1906. p. 228.

(4) Leriche, R.: The Surgery of Pain. Translated and edited by A. Young. William Wood & Co., Baltimore, Md., 1939.

(5) Livingston, W. K.: Pain Mechanisms. The Macmillan Co., New York, N. Y., 1943.

(6) Wolff, H. G.: Headache and Other Head Pain. Oxford University Press, New York, N. Y., 1948.

increasing the blood pressure and pulse, producing nausea, vomiting, and involuntary bowel movements, et cetera. Therefore, if for no other reason, pain should be specifically treated because of these serious generalized effects.

CONDUCTION OF PAIN

The conduction of pain centrally involves a minimum of three neurons: (1) receptor or primary, (2) connector, and (3) central. Free nerve endings in the skin and elsewhere go to the cell station of the receptor neuron which is in the posterior root ganglion. From there its central process extends through the lateral division of the dorsal root. Short ascending and descending fibers do not extend more than one or two cord segments and terminate in the gray matter of the apex of the dorsal horn where they form a synapse with the connector neurons. These secondary neurons immediately cross the cord in the ventral white commissure from their cell stations in the dorsal horn gray matter and go centrally in the spinothalamic tract to the thalamus. The central neuron cell stations are in the thalamus and in the postcentral gyrus of the cerebral cortex. The thalamus is the primary receiving station for all types of sensation and awareness and is the seat of primitive emotion. In the postcentral gyrus and other gyri, to a minor degree, is found spatial representation, making it possible to feel pain in the fifth finger as such rather than in the ulnar nerve. The physical sensation of pain is modified by an interplay between the thalamus and the cerebral cortex, chiefly the postcentral gyrus (*5*, *7*).

The autonomic nervous system is also involved in the conduction of painful sensation. Clinically, Leriche (*4*) believed that sensory fibers supplying the peripheral parts of the body pass through the sympathetic ganglia to the cord. Based on this belief, as early as 1913, he performed a periarterial sympathectomy for Raynaud's disease with successful results. From 1929 to 1939 his operation of choice for the majority of painful conditions of limbs was on the sympathetic nervous system. He stated that unknown factors regarding pain may be solved with better understanding of the intraspinal sympathetic. Gerard (*8*) believed that the autonomic nervous system can be involved in pain, both on the efferent and afferent side, through the unmyelinated C fibers. Recent experiments may bring about a change of thinking in regard to the relationship between the autonomic nervous system and pain. If it is true that all pain impulses from the extremities are carried by fibers which go directly to the spinal cord without entering the sympathetic chain (*5*, *9*) and opera-

(*7*) Brodal, A.: Neurological Anatomy in Relation to Clinical Medicine. Oxford University Press, New York, N. Y., 1948.

(*8*) Gerard, R. W.: Physiology of pain; abnormal neuron states in causalgia and related phenomena. Anesthesiology 12: 1-13, Jan. 1951.

(*9*) Kuntz, A.: The Neuroanatomic Basis of Surgery of the Autonomic Nervous System. Charles C Thomas, Publisher, Springfield, Ill., 1949.

tions on the sympathetic ganglia do stop extremity pain, then some explanation other than pain conduction along the sympathetic nerves must be sought. Perhaps it is the production of vasodilatation. The above statements refer to peripheral pain; visceral pain involves other factors. Sensory neurons conducting pain impulses from the internal organs do traverse the sympathetic chain to reach the spinal cord.

Pain conduction involves two differing viewpoints. Is pain a specific or a nonspecific sensation? Histologically, Wolff and Hardy *(10)* have found a physiologic unit with a single cell in the dorsal root ganglion connected to naked nerve endings in the skin. Further evidence to support the specific sensation theory is that surgical transection of the spinothalamic pathways can produce loss of pain in circumscribed regions without loss of temperature, sense or touch. Wikler, Goodell, and Wolff *(11)* have given analgesic drugs which raised the pain threshold 35 to 80 percent without affecting the threshold for perception of touch, hearing, smell, warmth, et cetera. There is also evidence that certain structures (such as the teeth and the middle meningeal and temporal arteries) are equipped for and give rise to pain sensation only. Other structures (the brain parenchyma and an area inside the cheek opposite the second molar) do not respond to painful stimulation.

The experiments of several workers have shown that by stimulation of discrete spots in the skin, each of the 4 major sensations can be elicited separately, and have concluded that each of these sensations have their own anatomic structure and receptors. This is further supported by the finding that the sizes of the nerve fibers vary according to the sensation they subserve—pain fibers, small; touch fibers, large *(5)*.

Livingston *(5)*, in quoting from Head's concept of central integration of sensory impulses *(12)*, brings out the point that some of the experimental findings, while valid, are impractical in the clinical consideration of specificity because the usual clinical stimulation, whatever the type, will activate more than one neuron. Therefore, the impulses which underlie any sensation represent a composite of impulses arising from more than one end organ. These impulses register centrally as a pattern of excitation and from it the sensations described as touch, pain, and temperature are extracted. This seems to be the happy medium between the theorists supporting specificity and those who support nonspecificity. Leriche *(4)* believed that areas for pain reception can receive other sensations under certain circumstances. He believed

(10) Wolff, H. G., and Hardy, J. D.: On the nature of pain. Physiol. Rev. 27: 167-199, Apr. 1947.

(11) Wikler, A.; Goodell, H.; and Wolff, H. G.: Studies on pain; effects of analgesic agents on sensations other than pain. J. Pharmacol. & Exper. Therap. 83: 294-299, Apr. 1945.

(12) Head, H., et al.: Studies in Neurology. Oxford University Press, New York, N. Y., 1920. Vol. 2, p. 831.

that increasing amounts of stimulus produce first touch, then pain; therefore, the same pathways are used for all sensations. In support of the nonspecific theory, it may be shown that patients under spinal anesthesia, when subjected to the same stimulus, may call it touch, heat, or pain. If one must compromise, Head's concept is perhaps the one to be accepted.

Other points in the conduction of the pain impulse are propagation, after-discharge, inhibition, facilitation and integration, summation, and speed of conduction of impulses. Each of these factors enter into the pain mechanism in minor or major degree. Each one shall be considered as a separate entity.

Propagation of the nerve impulse with a persistence of pain when the initiating factor is gone is probably explained on the basis of the internuncial pool. This is also called after-discharge—referring to the relatively prolonged effect produced on the activity of the anterior horn cells by a single afferent stimulus. This sustained activity is maintained within internuncial neurons. These are neurons interposed between the afferent and efferent units taking part in reflex activity. Groups of these cells are called the internuncial pools. The pool provides both spatial and temporal dispersion of impulses so that one impulse may reach horn cells at different times and at different levels, therefore, sustaining that impulse *(5)*.

The concept of the internuncial pool has been used to illustrate certain forms of inhibition. One property of the neurons of the first order is to inhibit a sensory impulse before reaching the secondary neuron. They are actively engaged in the integrative functions affecting all normal sensory impulses. It has been suggested that the discriminative sensations of touch, posture, et cetera, normally exert an inhibitory influence on the pain impulses so that the latter must be relatively strong to break through into consciousness. Although no experimental evidence is in the offing, this is probably true, otherwise everyday living and learning would be difficult because then every other impulse would be painful.

The integrative function of the horn cell is also concerned with the phenomenon of facilitation. Livingston *(5)* defines this term as follows: "It has long been known that a first 'conditioning' volley of afferent impulses increased the magnitude of response to a second 'testing' volley. The greater reflex effect of the testing volley can be explained as due to the arrival at the motor horn of some of its impulses coincident with the arrival of impulses set up by the conditioning volley which have been delayed in reaching the anterior horn cells by passing through longer chains of the internuncial pool."

Following the discharge of a nerve fiber, after-potentials may be demonstrated. Initially there is a complete refractory period during which the fiber cannot respond to any further stimulation. This is

followed by an interval during which this fiber is "supernormal" and will respond to a second stimulus of less than the usual threshold intensity. This latter phenomenon (when an impulse arrives at a cell station which is ready and anxious to receive it and responds in more than expected or exaggerated manner) is called *summation (13)*.

The size of nerve fibers have an interesting bearing on pain. There is an exact relationship between fiber size and the rate of conduction of nervous impulses. A fibers are myelinated, measure from 1 to 20 microns in diameter and transmit impulses at a speed of from 5 to 100 meters per second. C fibers include the smallest myelinated fibers and the unmyelinated fibers. These conduct at a rate of from 0.5 to 20 meters per second. B fibers overlap the others both in size and rate of conduction. Pain may be transmitted through B and C and the smaller A fibers. Therefore, the rate of conduction may vary from 0.5 to 30 meters per second. "Hence it would be anticipated that when a strong stimulus is applied to the body surface so as to initiate impulses in different types of pain conducting fibers, separate trains of impulses would travel centrally but each at its own rate, so that when they reached the sensorium distinct sensations of pain would be experienced" *(5)*. This has brought out the terminology of the fast and slow pain. The fast pain sensations, those reaching the sensorium rapidly, are the more vivid, less persistent and more readily localizable. The slow pain is diffuse, difficult to localize exactly, and reverberating. Wolff *(6)* concluded that the fast pain has a pricking quality, the slow pain a burning quality. "The impulses may be initiated by a wide variety of stimuli; they are probably picked up by more than one type of receptor end-organ; certainly they are carried by fibers of widely variant diameters and at quite different velocities" *(5)*.

PAIN THRESHOLD

The pain threshold is the lowest perceptible intensity of pain *(6)*. Although some investigators consider the threshold to pain a fairly constant physiologic phenomenon, there is extensive clinical support for the thesis that the pain threshold varies greatly in different persons and in the same person at different times *(14)*. This variation in pain threshold seems to be associated with personality traits, alterations in emotional texture, environmental factors, and fear. Leriche *(4)* has said, "Physical pain is not the simple affair of an impulse traveling at a fixed rate along a nerve. It is the resultant of the conflict between a stimulus and the whole individual."

Among the many methods devised for measuring the pain threshold is Hollander's technic of placing a jagged sheet of metal on the arm and wrapping a sphygmomanometer cuff around it. The threshold is high if the pressure exerted is 200 mm. Hg. before experiencing pain

(13) Lewis, T.: Pain. The Macmillan Co., New York, N. Y., 1942.
(14) Rovenstine, E. A., and Papper, E. M.: Therapy of Pain. S. Clin. North America 28: 484-492, Apr. 1948.

and low if 120 mm. Hg. will elicit discomfort *(14)*. Perhaps the most satisfactory method is that of Bazett, adopted by Wolff, of heating the surface of the skin. This is based on the fact that sensation elicited by heating the skin is a direct result of the change in the thermal gradients ,near the skin surface. The change in these thermal gradients is directly proportional to the intensity of the thermal energy brought to bear on the skin, thereby demonstrating that this quantity, measured as the stimulus, is directly proportional to the amount of pain producing disturbance at the pain ending. This stimulus measured in thermal energy can be expressed quantitatively in millicalories per second per square centimeter. By this method, Hardy et al. *(15)* have deduced that the pain threshold in man is relatively stable and uniform when measured in instructed subjects and that it is independent of age, sex, various emotional states and fatigue *(6)*. This inference is strictly a Wolff, Hardy, and Goodell concept with many dissenters.

In the measurement of pain threshold, a distinction must be made between perception of and reaction to pain, the two major aspects which must be kept in mind. Dissociation between pain perception and a reaction to pain is frequently found.

CLINICAL FACTORS

Leriche *(4)* believed that there are two types of pain. One is fixed with no symptoms beyond the region of the affected nerve and with no affect on the patient's personality. The other is changeable, associated with vasomotor troubles, trophic disturbances, and may well affect the psyche. His explanation for this is that the former originates in the territory of a cranial or spinal nerve with a fixed distribution; the other depending on the sympathetic nervous system with its intricate system of physiologic intercommunication.

Pain has been divided into that which is cutaneous and that which is deep. The former has been discussed under speed of conduction of nerve impulses. It was stated that one type of cutaneous pain was pricking in quality and fast; the other type was burning and slow.

Wolff *(6)*, in agreement with Lewis *(13)*, has divided deep pain into three categories:

1. *True visceral and deep somatic pain.* This type of pain is felt at the site of primary stimulation and may or may not be associated with referred pain. It is stopped by injection of procaine at the site of stimulation or by blocking the afferent nerves. It is not altered by infiltration of procaine into other structures supplied by the same or adjacent neural segments.

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(15) Hardy, J. D.; Wolff, H. G.; and Goodell, H.: Studies on pain. New method for measuring pain threshold: observations on spatial summation of pain. J. Clin. Investigation 19: 649-657, July 1940.

2. *Referred pain.* This may occur in addition to or in the absence of the true visceral and deep somatic pain described above. It is experienced at a site other than that of stimulation, but in tissues supplied by the same or adjacent neural segments. It may occur either with or without associated hyperalgesia and hyperesthesia.

a. Referred pain without superficial and/or deep hyperalgesia. In this case pain depends only on the central effects of the spread of excitation of the original noxious impulses to the same and adjacent segments of the cord whence they are relayed to higher centers for perception and interpretation. Injection of procaine into superficial or deep regions of referred pain does not reduce the intensity of pain due to this mechanism.

b. Referred pain with superficial and/or deep hyperalgesia. Referred pain may be accentuated in intensity by virtue of the effects of ordinarily nonnoxious stimuli from zones of reference. Impulses from such sources, normally inadequate to produce pain, may do so on reaching the cord in a segment involved in central spread of excitation. Procaine injected into superficial or deep hyperalgesic structures will abolish this element of the referred pain phenomenon resulting in more or less reduction of the subject's discomfort, depending on the amount of hyperalgesia.

3. *Pain due to secondary skeletal muscular contraction that provides a fresh source of noxious impulses.* Pain may result from secondary effects of the central spread of excitation on the effector structures, including painful contractions of skeletal muscles. Such disturbances may be widespread and the pains may be experienced in situations remote from the original source of noxious stimuli. Local infiltration of the contracted muscle with procaine abolishes this type of pain by disrupting its peripheral mechanism.

Causalgia is perhaps the most interesting of the pain syndromes. The symptom complex was first named and in part described by Mitchell *(16)*. The phenomenon is a result of a penetrating wound involving a peripheral nerve. It most commonly follows an injury by a high-velocity missile. The outstanding feature of the disorder is burning pain, usually slow in character, poorly localized, irradiating, throbbing, or aching. The pain may begin with injury or be delayed several weeks. It may last up to 2 years. It tends to increase in duration and in the area involved. The pain is usually referred to the distal part of the extremity and is usually more intense in the autonomous zone of the injured nerve. The involved parts show extreme hyperesthesia so that the slightest motion or draft of air causes extreme pain. The patient may gingerly hold the extremity in one position for hours on end. The personality is frequently greatly altered to the point of marked

(16) Mitchell, S. W.: Injuries of Nerves and Their Consequences. J. B. Lippincott Co., Philadelphia, Pa., 1872.

instability due to the constant, intense pain. Marked trophic and vasomotor changes in the painful part, such as glossy skin and elevation of temperature, are common. The symptom complex has the devastating ability to leak around any type of surgical block *(8, 17)*.

There appears to be a fundamental abnormality, some sort of overactivity that the cells develop. Lorente de No *(18)* has invoked the principle of reverberating circuits to explain it. One neuron activates a second; this, a third; and so on until the last one reactivates the first, leading to a trapped impulse running around and around in neuron circles. It is an attractive theory and could explain causalgia; a single impulse starts some neuron chain reverberating; additional impulses coming in out of phase or in other positions would tend to disrupt, but continued impulses in appropriate channels would tend to reinforce and maintain it. Such reverberating nets would constitute the maintained abnormal dynamic state of the cord neurons.

Gerard *(8)* has another explanation: "In the cord, under causalgic conditions a hypersynchronization, a firmer locking together of a larger than normal number of neurons, has occurred to form a pulsating pool, and that this synchronization has become exaggerated by virtue of the lack of disturbing impulses to disrupt the synchrony and by reinforcement with those specific pain afferents that are feeding in to lock the neurons. Such a pulsing pool could recruit additional units, could move along in the gray matter, could be maintained by impulses different from and feebler than those needed to initiate it, could discharge excessive and abnormally patterned volleys to the higher centers. In short, such a hypersynchronization could be physiological inflammation that would account for the phenomena" of causalgia.

The most recent treatment for causalgia is an attack on the sympathetic nerves. Nerve block is always transitory and sympathectomy is usually resorted to. Periarterial sympathectomy of Leriche is still successful in a fair number of patients. Livingston advocated neurolysis and nerve resection, but Mayfield *(17)* and Rovenstine *(19)* believed the method to be unsatisfactory.

The minor causalgias, a term coined by Homans *(20)*, are burning, posttraumatic reflex dystrophies. Minor causalgia differs from true causalgia in not being as severe and in having a definite vasospastic element. They may have nothing to do with peripheral nerves. Usually no more than 3 sympathetic nerve blocks are necessary for adequate therapy.

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(17) Mayfield, F. H.: Causalgia. Charles C Thomas, Publisher, Springfield, Ill., 1951.

(18) Lorente de No, R.: Transmission of impulses through cranial motor nuclei. J. Neurophysiol. 2: 402-464, Sept. 1939.

(19) Rovenstine, E. A.: Personal communication.

(20) Homans, J.: Minor causalgia: hyperesthetic neurovascular syndrome. New England J. Med. 222: 870-874, May 23, 1940.

Phantom limb is the sensation of an amputated limb still being present. Pains in phantom limbs are bizarre, the most common being associated with a sensation of a fixed position with crampy spasm. The next most common sensation is that the extremity is flopping around. Sometimes the patient has the feeling that the finger nails are tearing into the flesh. The phantom limb may feel hot or cold. The generally accepted mechanism of phantom pain is based on locomotion. The ability to move an extremity automatically is based on a co-ordinated set of impulses set up by vision, posture, and body surface sensation. If any of these are interfered with, co-ordination is broken up and the learning process must be repeated. This co-ordination is also subject to central inhibition. If the patient is unable to overcome psychogenically these alterations in surface and postural impulses, then pain ensues. The pain pathways involve the sympathetic nervous system. Treatment of phantom pain usually is injection of these sympathetic nerves. On occasion thorough infiltration of the stump gives relief. Revision of the stump, chordotomy, and lobotomy give poor results *(19)*. A new form of therapy, as yet untried, is based on the fact that the nerve impulses to the sensorium are confused and mixed up. It is suggested that pounding the stump to the limit of the patient's tolerance will provoke a standard set of impulses and perhaps establish a new pattern to the cortex *(21)*.

TREATMENT

The therapy of pain involves elimination of the stimuli, interrupting the pain pathways either temporarily or permanently, raising the pain threshold, modifying the reaction to pain, deadening perception to pain, et cetera.

Abolition of the pain stimulus if at all feasible is obvious but frequently forgotten. A second method of attack is interruption of the physiologic stimuli by nerve block and/or surgical resection. Nerve blocking must be applied with meticulous attention to anatomic detail if the best results are to be obtained. In the final analysis, it is not definitive treatment for pain. It has its greatest value as a diagnostic aid to the surgeon in anticipating the type of operation needed *(14)*. There are many instances when operation is not feasible (as in terminal carcinoma which is amenable to nerve block, or in instances where interruption of a vicious cycle can be accomplished with one injection), but, in most instances, nerve block is preliminary to operation. Surgical interruption of the pain pathways may be accomplished at: the peripheral nerve, the posterior roots, the spinothalamic tract, or the sensory cortex *(5)*. Operations on the sympathetic nerves are becoming more and more numerous, based on the fact that (1) these nerves regulate the tonus of blood vessels and (2) that sensory neurons conducting pain impulses from the internal organs traverse

(21) Risteen, W. A.: Personal communication.

the sympathetic chain to reach the spinal cord. Therefore, indications for sympathetic interruption would be vasospastic entities and uncontrollable visceral pain.

A third approach to the therapy of pain has, as its aim, the raising of the pain threshold. This is regularly accomplished with drugs which depress brain centers concerned with the reception of impulses carrying pain. Intimately connected with raising the pain threshold by the use of analgesics is a modification of the reaction pattern. Not only does morphine produce pain relief but also a euphoric state, thus changing the patient's reaction to the painful stimulus. Human understanding and insight into the nature of the problem are also aids in combating pain. Lobotomy and topectomy are the most dramatic of the attempts to alter the reaction pattern. Following topectomy, patients still have pain but it no longer "bothers" them *(14)*.

General anesthesia, rendering the patient totally insensitive; specific therapy such as adrenocortical extract in arthritis; and physical medicine are also tools to be considered *(14)*.

CONCLUSION

Pain is difficult to define. It may or may not be a protective reflex. The subjective reactions to pain vary from person to person, group to group, and race to race. Pain is conditioned by experience and strong beliefs. It is a specific sensation, usually passed along specific pathways, but noxious impulses may pass along different pathways or arise from different sources.

The Sedimentation Rate in Acute Cholecystitis[1]

Thomas H. Hewlett, *Lieutenant Colonel, MC, U. S. A.* (2)

FAHRAEUS, while searching for a test which would reveal early pregnancy, in 1914 discovered that the suspension stability of blood was altered in pregnancy and that sedimentation speed was accelerated in several diseases. He called attention to the fact that variation in suspension stability was probably the basis for the ancient Greek theory of the 4 humors of the body. Writing of these humors, early observers indicated their primary interest to have been the grayish white fibrin leukocyte layer appearing in the upper portion of clotted blood. Thirty-two years after the introduction of the sedimentation rate as a laboratory procedure, its true nature is as yet not clearly understood. The more recent investigations into the nature of the phenomenon have been directed toward determining its relationship to protein factors in the blood. These studies suggest that sedimentation rate, at least in part, is dependent on the relation of various protein factors to one another, an increased fibrinogen leading to an accelerated rate and increase of gamma globulin having practically no effect on the rate.

The normal person presents a relatively great concentration of red blood cells in a large volume of plasma. Downward and upward forces approach equality, thereby minimizing the sedimentation rate. In those instances where erythrocyte density is greater than the density of the medium, sedimentation will take place. Changes in the alteration of the physical state of the plasma colloids produce variations in the surface charges of red blood cells and thereby influences aggregation. Ropes et al. (3), in reporting studies of sedimentation, concluded that variations in the colloidal state of the plasma with consequent changes in the electric charges of the proteins and erythrocytes offer the only concept explaining the variations in sedimentation rate noted in disease.

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(2) U. S. Army Hospital, Camp Breckinridge, Ky.

(3) Ropes, M. W.; Rossmeisl, E.; and Bauer, W.: Relationship between erythrocyte sedimentation rate and plasma proteins. J. Clin. Investigation 18: 791-798, Nov. 1939.

The sedimentation rate may be considered a nonspecific reaction measuring the presence and intensity of morbid processes. In chronic systemic disease and localized inflammatory processes the sedimentation rate tends to remain accelerated after the temperature, pulse, and leukocyte count have returned to normal. The usefulness of the test has long been recognized in tuberculosis, pelvic inflammatory disease, and rheumatic fever, particularly when the test is used to follow the activity of the pathologic process. The variations noted in these diseases serve to prove that a decreasing sedimentation rate is consistent with subsiding infection and that an acceleration of the rate occurs with a change in the nature or extent of the inflammatory process. These facts suggest the applicability of this test in studying other similar processes, particularly within the abdominal cavity where certain inflammatory conditions exhibit a tendency to remain localized in their early stages.

Bannick et al. *(4)* called attention to the fact that much confusion has resulted from numerous highly technical reports in reference to performance and corrections necessary when using this test. Undoubtedly numerous variations in technic and equipment, suggested corrections for anemia, temperature, et cetera, have tended to devaluate the test in the minds of many clinicians. Studies performed by these authors indicate that the sedimentation rate in anemia is not so rapid as in the several dilution experiments reported and that the accepted corrections for anemia tend to overcorrect. In most cases where the sedimentation rate has definite clinical value, the uncorrected rate is usually normal or significantly abnormal. They consider the sedimentation rate to have general applicability and practical value as an indicator of activity in tuberculosis, pelvic inflammatory disease, acute cholecystitis, rheumatic fever, infectious arthritis, thoracic infections and suppuration, Hodgkin's disease, acute febrile illness, and acute coronary disease. Lesser and Goldberger's *(5)* observations of the slow sedimentation rate in acute appendicitis have been confirmed. Acceleration of the sedimentation rate in appendicitis occurs only with perforation and peritoneal insult. Markus and Joseph *(6)*, following sedimentation rates during the first 30 hours of acute appendicitis, noted that the sedimentation rate remained within normal limits and served thereby to differentiate appendicitis from adnexal disease. Lohr *(7)*, reporting on 30 patients with cholelithiasis coming to operation, noted a marked acceleration of the sedimentation rate which was not dependent on jaundice or temperature.

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(4) Bannick, E. G.; Gregg, R. O.; and Guernsey, C. M.: Erythrocyte sedimentation rate; adequacy of simple test and its practical application in clinical medicine. J. A. M. A. 109: 1257-1262, Oct. 16, 1937.

(5) Lesser, A., and Goldberger, H. A.: Blood sedimentation test and its value in differential diagnosis of acute appendicitis. Surg., Gynec. & Obst. 60: 157-166, Feb. 1935.

(6) Markus and Joseph: Cited in footnote reference *(5)*.

(7) Lohr: Cited in footnote reference *(13)*.

American surgical literature of the past 20 years contains numerous reports dealing with acute cholecystitis, and as might be expected, the subject is always approached from the standpoint of therapy: immediate or delayed operation. Heuer *(8)*, a staunch advocate of immediate operation, depended on clinical findings as the principal criteria necessitating emergency operation. His reports implied that laboratory studies failed to indicate the course of the pathologic process within the gallbladder. Graham *(9)*, an exponent of delayed surgery, suggested that biliary colic without inflammation might well satisfy the clinical criteria demanding emergency operation, but pointed out that inflammatory processes within the gallbladder tend to remain localized and certainly do not cause generalized peritonitis with anything like the same frequency as appendicitis. Problems of treatment of acute cholecystitis are not within the scope of this report, but reference is made to the two basic therapeutic ideas to call attention to the fact that reports of both schools of thought fail to mention the use of the sedimentation rate in the preoperative study and evaluation of patients.

Behrend and Gray *(10)* considered the problems created by attempting to correlate clinical, surgical, and pathologic manifestations in acute cholecystitis. They noted clinical findings to be misleading and generally inconsistent with the acuteness of the process. Pain and tenderness in the right upper abdominal quadrant were difficult to evaluate and when considered with other routine clinical observations led them to conclude that the true subsidence of cholecystitis could not be determined on the basis of clinical findings alone. Eckel *(11)* stated that leukocytosis is usually present in acute cholecystitis but often is not a reliable indication of the severity of the process, a white blood cell count over 20,000 frequently being associated with gangrene, pericholecystitis, and perforation. Fallis and McClure *(12)* believed that a proportion of polymorphocytes approximating 90 percent or a white blood cell count rising over 20,000 in the presence of adequate symptoms and signs requires early operation; but they have been impressed with the fact that a normal leukocyte count may be present when the gallbladder is gangrenous. In a series of 320 cases the operating surgeon made a diagnosis of *chronic* cholecystitis in 10 percent but pathologic study of these specimens revealed adequate

(8) Heuer, G. J.: Surgical aspects of acute cholecystitis. Ann. Surg. 105: 758-764, May 1937.

(9) Graham, R.: Cited in footnote reference *(8)*.

(10) Behrend, A., and Gray, H. K.: Acute cholecystitis; problems created by attempt to correlate its clinical, surgical, and pathologic manifestations. Surgery 3: 195-199, Feb. 1938.

(11) Eckel, J. H.: Symposium on surgical emergencies; acute cholecystitis. S. Clin. North America 30: 451-459, Apr. 1950.

(12) Fallis, L. S., and McClure, R. D.: Acute cholecystitis; review of 320 cases. Surg., Gynec. & Obst. 70: 1022-1028, June 1940.

evidence of *acute* cholecystitis. Leidberg *(13)* used the sedimentation rate in observing a statistically significant number of patients with acute cholecystitis treated medically.

METHOD OF STUDY

Procedure. Sixty patients admitted to surgical services with a diagnosis of cholecystitis were chosen for study during the preoperative period. Patients with coincidental diseases which would influence sedimentation rate were not included in the series. The following clinical manifestations were noted on admission and observed during the preoperative period: temperature, pulse, tenderness in the right upper abdominal quadrant, guarding, and the presence of a palpable mass in the right upper abdominal quadrant. Increase or decrease in clinical findings were recorded for each patient. Routine blood counts, sedimentation rate, and hematocrit were performed on admission. The sedimentation rates were repeated at intervals. A zinc sulfate turbidity test was done on patients entering the hospital with jaundice or those giving a history of recent jaundice. This test was repeated in patients with an elevated gamma globulin on admission or in a few instances in which jaundice temporarily increased. This test was performed on 17 patients and was found to be consistent in results with other more generally used liver function tests. A persistently high gamma globulin was noted in 1 patient who developed a cholangitis. The elevated gamma globulin returned to a normal level 10 days after other evidences of subsiding disease were noted.

Technics. Sedimentation rates were performed by the Wintrobe method *(14)*. Hematocrit determinations were performed on a sedimentation rate specimen in the Wintrobe tube by centrifuging for 30 minutes. In making the zinc sulfate turbidity test for gamma globulin, 0.1 cc. of serum was removed from the Wintrobe tube by pipet and transferred to a standard tube containing 6 cc. of buffered zinc sulfate solution. The tube containing 6.1 cc. was allowed to stand for 30 minutes. The tube containing the specimen for testing and tubes containing the standard comparison solution of barium chloride were inverted several times to produce turbidity. The tube containing the specimen was compared with standards under good light until the matching standard was determined. The unit turbidity of a specimen having been obtained from a known standard was converted to grams per 100 cc. of gamma globulin by using the following formula: (units turbidity x 0.053) + 0.5 = grams per 100 cc.

Classification of acute cholecystitis. Pathologic study of surgically removed gallbladders indicates that a true acute catarrhal cholecystitis is rarely if ever seen, suggesting that few gallbladders are removed

(13) Liedberg, N.: Die Bedeuting der Blutsenkungreaktion in der Klinik der Akuten Cholecystitis. Klinische Studien über die akute Cholecystitis. Acta. chir. Scandinav. (supp. 47) 79: 57-88, 1937.

(14) Wintrobe, M. M.: Clinical Hematology. 2d edition. Lea & Febiger, Philadelphia, Pa., 1946.

during the course of a primary inflammatory process. Specimens here diagnosed as acute cholecystitis presented microscopic findings consistent with an acute exacerbation of chronic disease, namely, edema, hemorrhage, necrosis, and leukocytic infiltration superimposed on fibrosis. Eosinophilic and plasma cell infiltration were accepted as denoting chronicity. The pathologic classification of acute cholecystitis used here makes use of Foot's *(15)* 3 types of chronic pathologic change to which gangrene has been added.

1. Fibrotic. This is the common type, characterized by marked increase in fibrous tissue. The wall may be thin or thick. Sections may appear acellular with little or no mucosa or muscle.

2. Cellular. This is a more active process and is characterized by little fibrosis and aggregations of lymphocytes and plasma cells in the submucosa and walls.

3. Glandular. This is a rare form characterized by a proliferation of glandular elements of the mucosa, numerous Rokitansky-Aschoff sinuses, and hypertrophy and hyperplasia of the mucosa. The mucosa may appear polypoid.

4. Gangrene. This may be diagnosed grossly by sloughing of the wall. Microscopically little beyond necrotic debris is identified.

Based on this classification the patients studied fell into a chronic group composed of 15 patients and an acute group composed of 45 patients. Of the acute group 19 patients had more than 1 leukocyte count and sedimentation rate done prior to operation. The diagnosis of acute cholecystitis in the remaining 26 patients (those who had a single preoperative leukocyte count and sedimentation rate) was based on the pathologic examination of the surgical specimens.

RESULTS

Sixty percent of the patients with a pathologic diagnosis of *chronic* cholecystitis were found to have a sedimentation rate above 10 mm. Of this group, 77 percent had leukocyte counts within a normal range, implying elevation of the sedimentation rate without elevation of the leukocyte count in chronic disease. The most persistent finding in this group was mild upper abdominal tenderness. Other clinical findings were without significance (table 1). Five patients of this group are of special interest:

Case 5. This patient was admitted because of a positive history of gallbladder disease and a roentgenographic diagnosis of cholelithiasis. He had only mild tenderness in the upper right abdominal quadrant and no history of recent acute pain within the abdomen. At operation an acute ulcerated appendix was removed following cholecystectomy. Neither his leukocyte count nor his sedimentation rate was elevated.

(15) Foot, N. C.: Pathology in Surgery. J. B. Lippincott Co., Philadelphia, Pa., 1945. pp. 266-372.

Case 6. This patient entered the hospital 24 hours following subsidence of an attack of colicky pain. From the pathologic findings there was nothing to account for the elevated leukocyte count and slight rise in temperature. It may have resulted from the biliary colic.

TABLE 1. *Summary of findings in 15 patients with chronic cholecystitis*

Patient	Temperature range (° F.)	Pulse range	Abdominal findings	Leukocyte count	Sedimentation rate
1	98-98.8	80	None	9,600	3
2	98-99	74-80	Mild (T)	4,900	8
3	98.6	84	None	10,000	10
4	99.2-99.8	80-86	Mild (T)	4,500	5
5*	98.8	80	Mild (T)	8,300	12
6*	99.4-100	84-90	None	16,700	18
7*	99	80-86	Mild (T&G)	6,150	22
8	98-98.8	70-76	Mild (T)	6,800	9
9	99-99.4	72-80	Marked (T)	8,600	7
10*	98.6-99	80	Mild (T)	12,850	15
11*	99	70-74	Mild (T)	8,600	21
12	98-98.8	74-80	Mild (T)	7,250	19
13	98.6	76-80	Mild (T)	7,500	12
14	98	80	None	9,400	15
15	98.4	80	None	7,000	20

T = Tenderness G = Guarding
*Brief case report is given.

Case 7. This woman had mild tenderness and guarding with a sedimentation rate of 22. Pericholecystic adhesions were present. Microscopic examination of the gallbladder showed glandular hypertrophy. The sentinel node at the junction of the cystic and common hepatic ducts was thickened and inflamed. Three weeks prior to operation the patient was observed in a clinically acute attack during the third trimester of pregnancy. During this attack her leukocyte count did not rise above 9,100 with 77 percent polymorphocytes and the sedimentation rate remained between 37 and 40 during the week she was under observation. This patient demonstrates the rather slow descent of the sedimentation rate after an acute attack.

Case 10. This woman entered the hospital with a history of repeated bouts of discomfort in the upper right abdominal quadrant of 2 months duration. At no time during that period did soreness completely leave the right upper abdominal quadrant. In view of pathologic findings, including numerous minute gallstones, it can be assumed that she suffered a low grade colic during that period.

TABLE 2. *Summary of findings in 26 patients with acute cholecystitis who had a single preoperative sedimentation rate*

Patient	Temperature range (° F.)	Pulse range	Abdominal findings	Leukocyte count	Sedimentation rate	Pathologic classification
1*	103-98.6	120-80	Moderate to none	11,300	47	4
2	100.4-98.4	82-74	Moderate to none	19,000	29	4
3	98-99.6	99-100	Marked to minimal	10,500	47	2
4	97-99	70-80	Marked to none	13,000	49	1
5	98-103	96-110	Marked to minimal	11,050	43	2
6	99.8-100	90-80	Marked to none	15,900	31	2
7	99.4-99.8	74-100	Marked to minimal	8,800	44	1
8	100.2-99	84-78	Moderate to none	12,800	45	4
9	98-98.6	80-76	Minimal to none	7,800	28	2
10	100-101	90-100	Minimal to marked	18,200	43	4
11	98.7-101	78-90	Moderate	21,200	38	1
12	98-100	96-72	Marked to minimal	14,450	56	1
13	98-100.4	72-84	Minimal to none	11,250	29	2
14	98-99	72-80	Minimal to none	8,850	52	1
15	99-98.4	84-80	Minimal to none	7,500	54	4
16	98.2	84-72	Minimal to none	12,250	32	1
17*	99-99.6	94-80	Moderate to minimal	12,950	45	4
18*	98-98.6	80	None	11,700	50	1
19	98.8	80-84	Minimal to none	7,700	40	1
20	98.6-99.6	80	Minimal to none	7,600	45	3
21	99.8-98.4	90-80	Minimal	5,300	30	2
22	99.4	74-80	Minimal to none	7,800	23	1
23	99-98.4	86-72	Moderate	6,900	30	2
24	102-100	90	Minimal to marked	21,600	47	2
25	99.6-98	80-74	Marked to none	5,000	32	1
26	98	80-72	Minimal to none	6,200	47	3

*Serial sedimentation rates showed a rise to the reported level. They are included here because of a single leukocyte count.

Case 11. This patient also gave a history suggestive of continued low grade colic for 7 days prior to entering the hospital.

A pathologic diagnosis of *acute* cholecystitis was made from the surgical specimens of 26 patients (tables 2 and 3). Considering this group from the standpoint of clinical findings presumed to be consistent with the disease, the following points were noted.

1. Ten patients were admitted with white blood cell counts above 12,000. Of these, 7 showed improvement in clinical findings during the preoperative period on a conservative routine consisting of nothing by mouth, intravenous fluids, bed rest, 0.6 mg. of nitroglycerin under the tongue and morphine p. r. n.; 2 showed increased severity of clinical findings prior to operation; and 1 showed no change in the preoperative clinical findings. Patients in this group had an average sedimentation rate of 41.5.

TABLE 3. *Preoperative clinical findings in 26 patients with acute cholecystitis and a single sedimentation rate*

Patients (total)		Clinical findings			Leukocyte count		High sedimentation rate
		Improved	Increased	Unchanged	Elevated	Normal	
Number	26	20	2	4	10	16	26
Percent	100	77	8	15	38	62	100

2. Five patients were admitted with equivocal white blood cell counts ranging between 10,000 and 12,000. Of this group, 4 showed improvement in clinical findings; and in 1 they remained unchanged. An average sedimentation rate of 43.2 was noted in this group.

3. Eleven patients showed no elevation of the percent of polymorphonucleocytes. All the patients of this group showed improvement in clinical findings and their average sedimentation rate was 38.6.

Repeated sedimentation rates and white blood cell counts were done within 2 or 3 days on 19 patients admitted with clinical findings of *acute* cholecystitis. Thirteen (68.4 percent) of this group had white blood cell counts above 12,000 at the time of admission and 6 (31.6 percent) had white blood cell counts within the normal range (tables 4 and 5). Points of interest to be noted in analyzing this group were:

1. All of the 13 patients admitted with high white blood cell counts showed a significant drop in the total counts and the percent of polymorphonucleocytes prior to operation. All showed improvement in symptoms and abdominal findings, although in 4 slight elevations of temperature and pulse persisted. Eleven of the 13 showed a significant rise in sedimentation rate; 2 showing slight change in sedimentation rate were admitted with rates of 50 and presented minimal rises of 4. The average sedimentation rate on admission in this group was 27.9 and the average rise was 15.6.

TABLE 4. *Summary of findings in 19 patients with acute cholecystitis who had serial studies before operation*

Patient	Temperature range (° F.)	Pulse range	Abdominal findings	Leukocyte count	Sedimentation rate	Pathologic classification
1	101.4-99.4	90-80	Marked to minimal	16,450 11,000	44 56	4
2	102-98.6	100-80	Marked to minimal	12,250 8,400	39 51	4
3	99.6-98.4	82-76	Marked to none	10,000 7,750	48 57	2
4	99-101.4	96-120	Moderate to none	13,500 6,500	30 49	2
5	99-98.4	80-74	Mild to none	6,200 5,400	26 43	1
6	99-98.6	84-72	Moderate to none	12,700 12,000	24 33	2
7*	100-98.4	90-76	Marked to minimal	7,100 6,250	49 48	2
8*	99-98.6	80-72	Moderate to none	10,030 7,800	40 51	3
9	99-98	90	Moderate to none	18,000 10,200	18 38	3
10	99.4-98.2	90-80	Moderate	10,700 7,500	57 58	1
11	98.2-99.2	94-82	Marked to none	17,400 12,100	10 33	1
12	102-100	100-78	Marked to minimal	18,250 15,000	50 54	2
13	100-98.4	100-80	Moderate to minimal	8,450 6,850	38 43	1
14*	101-98.6	96-74	Marked to none	12,200 7,050	3 37	2
15*	98.2-100.2	80-90	Marked to minimal	17,500 12,000	13 42	1
16	100.4-98	80-76	Marked to minimal	16,250 7,500	50 54	2
17	98.8-100.6	90-100	Marked	26,700 10,000	41 56	1
18*	99	80-100	Marked to none	12,200 10,250	29 35	2
19	100-98.2	90-80	Marked to none	20,000 14,900	12 28	1

*Brief case report is given.

2. Six patients admitted with white blood cell counts within normal range presented an average admission sedimentation rate of 43 and showed an average rise of 7.

TABLE 5. *Preoperative clinical findings in 19 patients with acute cholecystitis and serial studies*

Patients (total)		Admission leukocyte count		Sedimentation rate		Clinical findings subsiding	Leukocyte count falling
		Elevated	Normal	Rising	No change		
Number	19	13	6	15	4	19	19
Percent	100	68.4	31.6	78.9	21.4	100	100

Case 7. This patient had a minimal drop in her leukocyte count and a relatively constant sedimentation rate. She was discharged from the medical wards 1 month prior to these studies, presumably recovered from an attack of acute cholecystitis. Her leukocyte count at the time of the prior admission was 7,280 with a 70 percent polymorphonucleocytes and a sedimentation rate ranging from 44 to 77 in 9 days, during which time all positive findings subsided. She was readmitted to the surgical service with the findings of acute cholecystitis.

Cases 8, 14, 15, and *18* were admitted with serum amylase ranging from 428 to 4,800 units. Serial sedimentation rates revealed daily rises of from 10 to 15 as leukocyte counts fell and improvement of abdominal symptoms were noted. At operation small stones were removed from the gallbladder or the common bile duct of each of these patients.

DISCUSSION

Surgical patients were chosen for the study in order to evaluate the correlation between the clinical findings, white blood cell count, sedimentation rate, and the severity of the disease process within the gallbladder. Classification of the disease was based on the pathologic findings mentioned previously. Fifteen of the 60 patients studied were classified as having chronic cholecystitis (table 1). Their symptoms, if any, were mild, being limited to tenderness in the right upper abdominal quadrant in 67 percent. Elevation of the white blood cell count was noted in 20 percent. Sedimentation rates ranged from 3 to 21 (average 13). This group demonstrated the fact that chronic disease of the gallbladder per se does not produce significant alterations in white blood cell count or sedimentation rate. In this group 90 percent had a previous roentgenographic diagnosis of cholelithiasis.

Analysis of 45 patients in whom a pathologic diagnosis of acute cholecystitis was made revealed the following. The hematocrit range in this group was from 37 to 46 (average of 41.8). In those patients

in whom correction of the sedimentation rate was done, the anemic factor was not severe enough to alter a significant rate, confirming findings reported by Bannick et al. *(4)*.

The subsidence of acute symptoms and decrease in abdominal findings were noted early in the disease in 84 percent of the patients. Under conservative treatment consisting of bed rest, intravenous fluids, nothing by mouth, and nitroglycerin and morphine as necessary, clinical improvement usually occurred. That such a favorable response did not necessarily indicate subsidence of the disease process was brought out by further analysis of this group. Sixteen patients were admitted with normal white blood cell counts (table 3); 6 additional patients, with no elevation of the leukocyte count; and 13 patients with falling counts were admitted (table 4). Thus in 77 percent of the 45 patients the leukocyte counts indicated subsiding disease. Evaluation of the patients, therefore, on the basis of clinical findings and leukocyte counts alone is inadequate when considered in light of the findings at operation and by the pathologist, and may be considered of little or no value in determining subsidence of the disease process within the gallbladder. We found no agreement between the clinical findings, white blood cell count, and sedimentation rate. Notable throughout the series were persistently high or rising sedimentation rates. In 19 patients studied by serial sedimentation rates and leukocyte counts, 78.9 percent had a rising sedimentation rate; 21.1 percent had a persistent elevation; and all coincidentally had a falling leukocyte count. These findings indicated a rather rapid rise in sedimentation rate from an initial rate of from 3 to 30, the average rise being 19.2. Patients admitted with an initial rate of from 38 to 57 had an average rise of 7.2.

Thus within this group of patients the sedimentation rate was the only finding consistent with the pathologic process associated with the individual case of acute gallbladder disease. Toward the end of the series we were able to predict approximately the type of disease which could be expected at operation solely on the basis of the sedimentation rate. In 3 patients who had completely recovered from their symptoms and abdominal complaints and who desired to go home, a high sedimentation rate led us to predict that technical difficulties might arise because of the extensive local disease. In each instance the inflammatory process was so extensive that a Thorek-type operation was all that could be attempted.

Our findings are of interest when compared with those of Leidberg *(13)* who studied the sedimentation rate of patients undergoing medical treatment for acute cholecystitis and sought to determine: (1) the stage of the disease in which acceleration of the sedimentation rate can be expected; (2) the relationship of the sedimentation rate during the early days of the disease to general and local symptoms; and (3) the reaction of the sedimentation rate during the course of the disease.

His results indicated a lag in sedimentation rate during the first 24 hours of the disease with a median of 15. The rate tended to rise rapidly to a median of 52 in from 48 to 72 hours after onset of the disease. We cannot agree with his observation that the sedimentation rate is in good agreement with the clinical findings because in this series the clinical findings and the leukocyte counts did not agree with the elevated sedimentation rates. Leidberg's observation that the sedimentation rate remained elevated for from 2 to 3 weeks indicating slow subsidence of the disease was confirmed. Our daily averages were within the median range determined by Leidberg.

Our findings indicated that a rising or persistently elevated sedimentation rate is consistent with increased severity of the local process within the gallbladder and is a more accurate gage of disease than clinical symptoms and abdominal findings in most patients. A rising or persistently elevated sedimentation rate is the only finding preoperatively that appears consistently to correlate with the severity of the pathologic process within the gallbladder.

CONCLUSIONS

Leukocyte counts, temperature and pulse curves, and careful observation of the day-to-day variation in the abdominal findings are inaccurate means of evaluating the acuteness of disease within the gallbladder. The fact that clinical observation and routine leukocyte counts have served and continue to serve as criteria for evaluating patients with acute cholecystitis seems due to the rather fortunate characteristic the disease shows to remain localized to the immediate vicinity. The sedimentation rate in acute cholecystitis follows the progressive rise noted by Leidberg. The sedimentation rate is frequently in disagreement with the symptoms and physical findings presented by these patients. The sedimentation rate offers a simple laboratory procedure which accurately indicates the course of the disease process within the gallbladder. The consistency of the sedimentation rate when used in acute cholecystitis renders it of value in either the medical or surgical management of such patients in that it offers a day-to-day finding which correlates with the severity of the disease more readily than any other laboratory or clinical finding.

Correction of Temporomandibular Disturbances by Jaw Repositioning

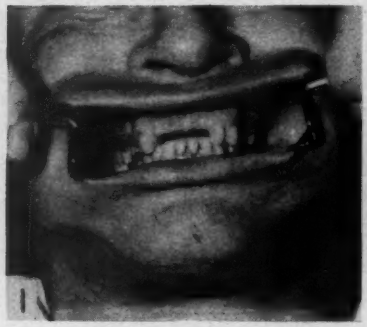
Leo J. Hoffman, *Captain, DC, U. S. A.*

THE case presented in this article is one of a typical temporomandibular disturbance wherein successful treatment was accomplished by repositioning the mandible to its correct relationship with the maxilla and establishing a balanced occlusion. The branch of dental science concerned with postural relationships of the jaws both normal and abnormal may be referred to as oral orthopedics. It involves the diagnosis, treatment, and correction of disturbances resulting from the harmful influence of improper relationships of the mandible to the maxilla on dental and other related structures *(1)*.

CASE REPORT

A 36-year-old man, otherwise in good health, complained of severe clicking of the temporomandibular joints accompanied by pain radiating to his left ear during and after mastication. He had been examined at various times in the preceding years but had not been given any relief. He was examined at the Fort Harrison dental clinic where study models were made and a full mouth series of roentgenograms was taken. The models and films revealed: (1) that teeth 1, 2, 7, 8, 9, 12, 13, 15, 16, 17, 18, 19, 30, 31, and 32 were missing; (2) advanced gingival recession on all the posterior teeth; (3) extrusion of the upper molar teeth; (4) that the patient wore an upper partial denture but no lower partial denture; (5) thickening of the periodontal membrane on the posterior teeth; (6) only slight bone loss because of the density of the bone; (7) numerous amalgam restorations; (8) very little decay; (9) that the bite was closed and locked to lateral excursions because of the retrusion of the mandible and because of the deep overlapping cusps of the upper bicuspids; and (10) that the patient was unable to maintain a lower partial denture because of the retruded mandible and closed bite (figs. 1-3).

(1) Lieb, M. M.; Kudler, G. D.; Ritt, R.; Friend, A. A.; and Curry, J. E.: Oral orthopedics. Dental Concepts 5-10, Jan. 1952.



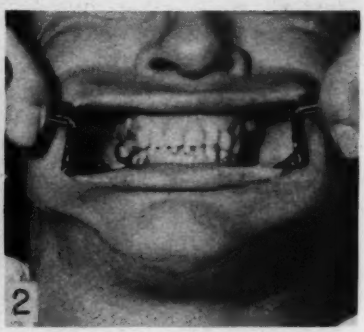


Figure 1. Photograph showing original bite. Note severe overbite. Figure 2. Original bite with old partial denture in position.

The patient's symptoms were typical of a temporomandibular disturbance. Relief was possible only by repositioning the mandible to a normal relationship with the maxilla and rebuilding the entire dental apparatus into a state of balance so that it could function smoothly as a unit without interference and with a minimum expenditure of energy, avoiding the destructive effect of trauma.

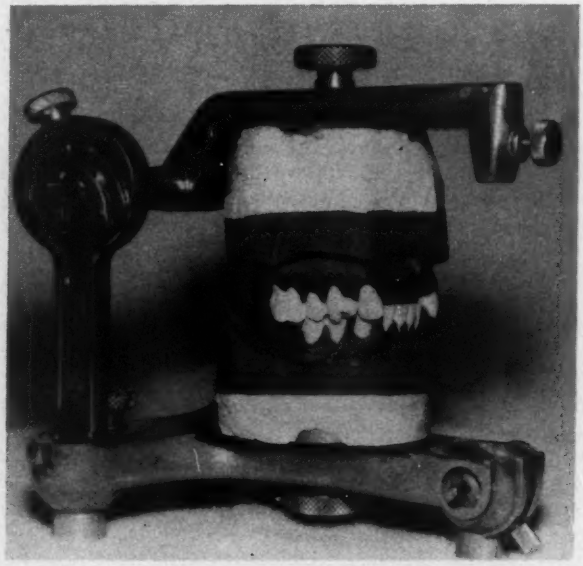


Figure 3. Lateral view of model showing articulation before treatment. Note retruded mandible and locked bite.

The treatment which was started immediately consisted of (1) a structural phase involving reorientation following a definite geometric plan; and (2) a physiologic phase consisting of muscular re-education for efficient use of the structurally corrected dental apparatus. Lack of attention to either would have resulted in failure.

First the correct position of the mandible where the effects of trauma could be minimized was determined. For this purpose the Stoll coordinator, which made it possible to orient the dental mass in the artic-

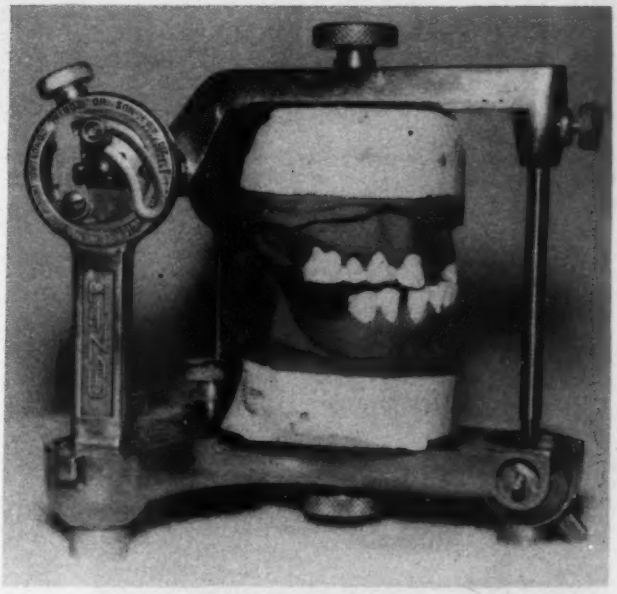
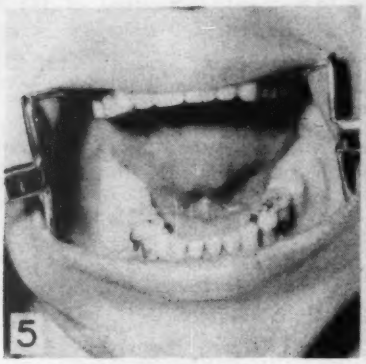


Figure 4. Mandible repositioned. Overlapping cusps have been removed. Note degree of posterior opening established.

ulator exactly as it is framed in the skull, with the same relation to the center and the horizontal and vertical planes of orientation, was used. Our object was to establish a relationship whereby the alveolar crests of the mandible and maxilla would be in the same vertical plane and horizontally parallel to one another. Obtaining this position enabled us to aline the teeth in such a way that their axial inclinations would meet each other in a straight vertical line. By attaining this position the normal relationship of the jaws was re-established, relieving the pressure on the temporomandibular joints, and creating a position in which with a balanced reconstruction of the mouth we could eliminate the destructive effects and the patient's symptoms (fig. 4). In establishing the desired position an increase in the interdental space was created. Upper and lower partial dentures of vitallium were



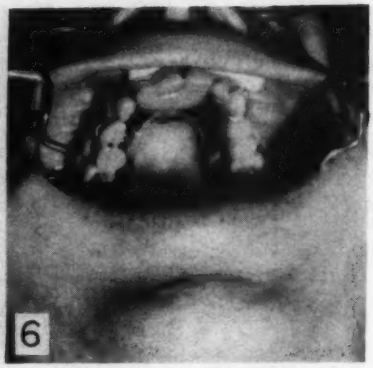


Figure 5. Lower appliance in position with acrylic onlays over lower bicuspids to build up bite. Figure 6. Upper appliance in position with acrylic onlays on right bicuspids, first molar, and upper left molar.

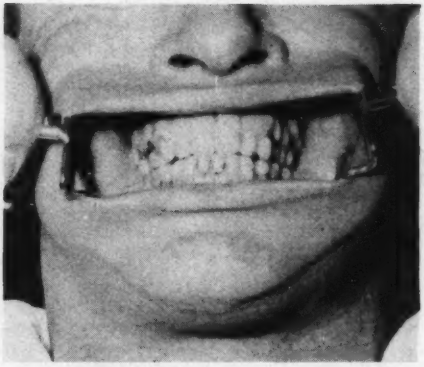


Figure 7. Upper and lower appliances in position. Note tip-to-tip relationship of anterior teeth.

constructed with acrylic onlays over the natural teeth and with the pontics built up to the same level to maintain this position. A tip-to-tip relationship was established for the anterior teeth (figs. 5-8).

The occlusion was balanced with these appliances in position and the patient wore these appliances for 2 months before any further treatment was initiated. During this time the patient made a conscientious effort to adapt himself to these appliances. He underwent a period of muscle training which consisted of opening and closing the jaws in the newly created occlusion until he was able to do this without any

determined conscious effort. He wore the appliances at all times and, needless to say, found it very uncomfortable for the first week. On awakening in the morning he found his jaws clenched, and during the course of mastication the appliance would slide back to the old position, but the lack of occlusion at that point immediately brought the jaw forward again. These inconveniences were expected for the first month. They disappeared, however, with the eventual relaxation of the musculature in the newly established position. The clicking of the temporomandibular joints ceased immediately on insertion of the appliances and the pain radiating to the ear subsided after the first week.

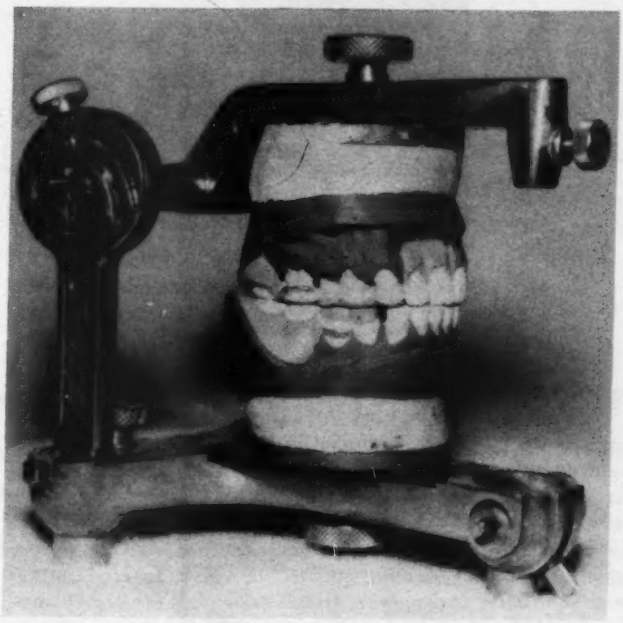


Figure 8. Model showing corrected position with upper and lower partial splints in position.

After 2 months, not only had the symptoms disappeared, but the muscular tension was gone and the patient felt perfectly comfortable. The length of time required to wear these appliances varies with the patient and the severity of the malocclusion. This patient had a very severe defect but his willingness to co-operate was a help in correcting it. With some patients it may require as long as a year to accomplish the same results.

The next procedure involved permanent rehabilitation of the mouth in this corrected position. The treatment of the lower jaw was completed first and this consisted of splinting veneer acrylic facing crowns

on the bicuspids of both sides and the insertion of a vitallium partial lower denture to replace the missing teeth of both free saddles. Both the crowns and the pontics were built up to the levels established by the first appliance with its acrylic onlays. During the construction of the gold crowns, temporary acrylic jackets were made to cover the prepared teeth and to maintain the appliance in the same position as it had before the teeth were cut down. The acrylic onlays of the appliance fitted over these acrylic jackets just as they did over the natural teeth and thus maintained the same position (fig. 9).

Figure 9. Temporary acrylic crowns placed over prepared teeth. Appliance reinserted in exact same position.

After permanent restoration of the lower level all the remaining upper teeth were prepared for cast gold veneer crowns and during this time the patient again wore temporary acrylic jackets as coverage for the prepared teeth and to aid in maintaining the upper appliance in its correct position. After all the castings were made, a permanent fixed bridge was constructed which extended from the upper right first molar to the upper left first molar. The bridge consisted of 14 units when completed. Half size second molars were cantilevered to the crowns of the first molars, the missing posterior teeth were replaced by acrylic pontics, and the missing anterior teeth were replaced by acrylic pontics on gold cores (figs. 10 and 11).

After cementation the final precision balancing of occlusion was accomplished. The result was complete contact of the working and balancing side of all the posterior teeth in any excursions of the mandible.

DISCUSSION

In analyzing the dental mechanism here involved, our problem was to find the structural center around which the jaws, teeth, ligaments, muscles, and fascias should be symmetrically arranged so that they could function with ease, without strain, and with minimal wear on the teeth and their supporting structures. Improper jaw relations not only

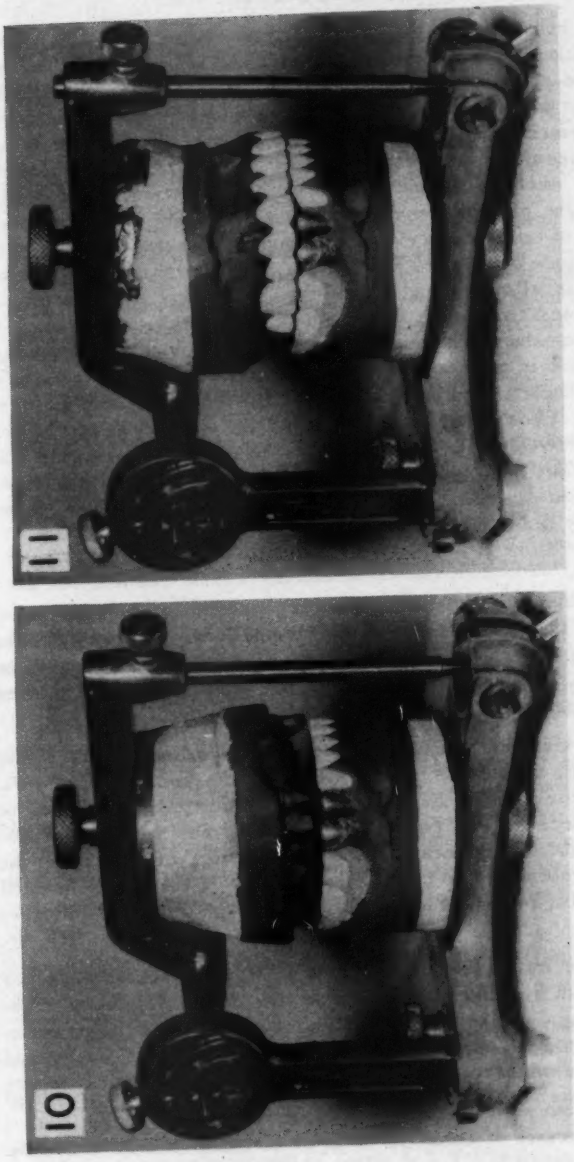


Figure 10. Veneer crown preparations on all upper teeth. Figure 11. Completed case.

affect the teeth and their supporting tissues but play a decisive role in causing pain in other structures of the head and neck.

The sensory stimuli which signal the accomplishment of a required movement constitute the neurologic pattern necessary to bring about an end of motor activity and rest. Traumatic occlusion as defined by Stoll (2, 3) is any trauma-producing occlusal relationship in either eccentric or centric position with incomplete and uneven contact of all the teeth, resulting in unequal, destructive distribution of forces on the chewing mechanism. Not only is such a situation mechanically inefficient, but the harmful stimuli which arise serve no useful purpose. In the presence of traumatic occlusion, even after chewing is completed, the remaining imbalance does not permit the symmetrical inflow of stimuli that would allow the end of activity. Thus there is a continuous inflow of impulses that result in spasm or pain. Inevitably traumatic occlusion accompanies an abnormal temporomandibular relationship and its correction is truly an orthopedic procedure. Such relationships also exert an important pathogenic influence on related structures of the head, neck, throat, and even on remote areas. The symptoms induced by such relationships include (1) pain in the temporomandibular area; (2) the radiation of pain to the various areas of the head, neck, mouth, tongue, throat, ears, or eyes; and (3) spasm in various groups of muscles in the head and neck.

SUMMARY

Temporomandibular disturbances when recognized can be eliminated by establishing the correct relationship of the jaws. The results are highly gratifying and the relief of symptoms shows that repositioning the mandible to its correct relationship and establishing a balanced occlusion has a sound physiologic foundation.

The occlusal surfaces maintain the correct postural relations of the jaw and guide all movements of the mandible, the condyles included. It is erroneous to assume that the condyles guide the movements of the mandible. Because the controlling center of the voluntary movements of the mandible is located in the motor area of the brain, the patient is able voluntarily to control the position of the mandible until his musculature becomes so adapted that it no longer requires voluntary control.

In cases where trauma is prevalent, in spite of a lack of pain, we can best establish a correct functioning of the dental apparatus, minimizing the stresses and strains on the individual teeth and their periodontal components, by establishing the proper interdental space and constructing a balanced occlusion. With the proper interdental space created we can establish more esthetic restorations.

(2) Stoll, V.: Importance of correct jaw relations in cervico-oro-facial orthopedia. Dental Concepts 5-9, Apr. 1950.

(3) Stoll, V.: The Dentist and His Patient. 1950. pp. 176-177.

Mosquito Survey of Guam

William B. Hull, *Lieutenant, MSC, U. S. N. (1)*

DURING World War II and in the following years, much work was done on Guam in regard to the epidemiology of mosquito-borne diseases and on the biology of the mosquitoes found there. As a follow-up to some of this work, the present survey was undertaken in an attempt to discover any changes that had taken place in the mosquito fauna present.

In 1944, a severe epidemic of dengue fever occurred among the military personnel on Guam *(2)*. Evidence indicated that *Aedes aegypti* (Linnaeus) was the vector. As a result of this epidemic, a mosquito survey was made early in 1945 *(3)*. *A. aegypti* was found at that time to be numerous throughout the central one-third of the island, where it was taken in artificial breeding places in native villages. Other mosquitoes found were: *Aedes pandani* Stone, *Aedes guamensis* Farner and R. Bohart, *Aedes vexans nocturnus* (Theobald), *Aedes oakleyi* Stone, *Culex quinquefasciatus* Say, *Culex annulirostris marianae* R. Bohart and Ingram, *Culex litoralis* R. Bohart, and *Culex sitiens* Wiedemann.

Although Bailey and Bohart did not find *Aedes albopictus* (Skuse), a good record of *A. albopictus* from Guam in 1944 was brought to light *(4)*. Weathersby was with the Third Marine Division as an entomologist on Guam in 1944 and 1945. He obtained larval skins and whole larvas of *A. albopictus* from Ylig Bay and Yona. Other mosquitoes from Guam in the Weathersby collection are *A. aegypti, A. guamensis, A. pandani, A. oakleyi, C. quinquefasciatus,* and *C. annulirostris.* Percentages of larval collections by Weathersby are not available so no figures comparable to the other surveys could be included in table 1.

Following their survey, Bailey and Bohart planned an extensive program for the control of *A. aegypti.* Their efforts were directed pri-

(1) Naval Medical Research Institute, National Naval Medical Center, Bethesda, Md.

(2) Bohart, R. M., and Ingram, R. L.: Mosquitoes of Okinawa and Islands in the Central Pacific. Navmed P-1055. Bureau of Medicine and Surgery, Navy Dept., Washington, D. C., 1946.

(3) Bailey, S. F., and Bohart, R. M.: Unpublished survey for *Aedes aegypti* on Guam during February 1945.

(4) Personal communication with Lt. Comdr. A. B. Weathersby.

marily at eliminating or controlling possible breeding places. As many unnecessary artificial water containers as possible were destroyed and essential water-storage barrels were covered with DDT-treated cloth (5). By midsummer, 1945, *A. aegypti* was said to be rare, and later was apparently eradicated in many areas (2).

TABLE 1. *Percentages* of larval collections of the more important species of mosquitoes in four surveys*

Species	Bailey and Bohart (3) (1945)	Yamaguti and LaCasse (6) (1948)	Reeves and Rudnick (7) (1948-49)	Present survey (1951)
Aedes aegypti	33.7	1.1		
Aedes albopictus		4.5	5.4	60.3
Culex quinquefasciatus	55.0	26.1	66.1	39.7
Anopheles subpictus indefinitus		25.0	4.1	7.2
Aedes guamensis	5.9	2.2	9.3	8.8

*The total number of larval collections in each survey is used as 100 percent for that survey. The percentages in each survey add up to more or less than 100 percent because of the fact that more than one species was often found in a single collection, or because of the other species taken in each survey but not included in this table.

In December 1947, an epidemic of Japanese encephalitis occurred on Guam. In connection with epidemiologic studies following this epidemic, a mosquito survey was made in February and March 1948 by the 207th Malaria Survey Unit, U. S. Army (6). A single collection of *A. aegypti* larvas was made by this unit from a water-storage barrel at Agat. Their survey recorded the occurrence of *Anopheles subpictus indefinitus* (Ludlow) on Guam for the first time. These mosquitoes were found to be rather numerous in the southern part of the island, as far north as the village of Talofofo. *A. albopictus* was also taken in 4 collections at Yona. All the other species listed by Bohart and Ingram (2) were taken except *C. sitiens.*

A more extensive survey was made by Reeves and Rudnick (7) from November 1948 through January 1949. Out of 2,189 larval collections and 250 adult collections, no *A. aegypti* were found. *A. albopictus* was found in 119 collections and was rather widespread from Talofofo north. Anopheles mosquitoes were found throughout the island from Tumon Bay south. These workers also collected all other species known from Guam except *C. sitiens.* A later report by Reeves and

(5) An article on this control project, by S. F. Bailey, is now in press.

(6) Yamaguti, S., and LaCasse, W. J.: Mosquito Fauna of Guam. 207th Malaria Survey Detachment, U. S. Army, 1950.

(7) Reeves, W. C., and Rudnick, A.: Unpublished survey of mosquitoes of Guam during November and December 1948 and January 1949.

Rudnick (8) combines the data of the 2 surveys mentioned. The article discusses the epidemiology of Japanese encephalitis, malaria, and dengue fever on Guam and makes general recommendations for control procedures.

SURVEY

During the period 5 August to 30 November 1951, the primary objective was to collect *A. aegypti*, if possible. In the beginning, therefore, most of the collecting was done in the central one-third of the island, where most of the *A. aegypti* had been found by Bailey and Bohart in 1945. Samples were taken from rain barrels, old automobile tires, and any other type of container-habitat in the vicinity of human dwellings where *A. aegypti* might be expected to breed. Most of these collections were in Guamanian villages. No *A. aegypti* adults or larvas were found at any time.

As the survey progressed, an attempt was made to sample all types of larval breeding places, both in the vicinity of human dwellings and in unfrequented areas. The whole island was covered, within practical limits. Out of 194 larval collections made, *A. albopictus* was taken in 117, *C. quinquefasciatus* in 77, *C. annulirostris marianae* in 22, *A. guamensis* in 17, and *A. subpictus indefinitus* in 14. A breakdown of the breeding places of these and 4 other species of mosquitoes taken is given in table 2.

A. albopictus had evidently spread over the entire island. Distribution records on Guam for this and other species taken in this survey are listed in table 3. To give an indication of the change in mosquito fauna on Guam in recent years, table 1 was prepared. The figures in table 1 from the survey reported on by Yamaguti and LaCasse are probably not strictly comparable because more of their time was evidently given to collecting from ground pools. It seems evident from the accompanying tables, however, that *A. albopictus* has become well established, filling the niche formerly occupied by *A. aegypti*. From the percentage figures in table 1 for *A. aegypti*, *C. quinquefasciatus*, and *A. albopictus*, it seems possible that *A. albopictus* in 1951 was even more successful in competing with *C. quinquefasciatus* than *A. aegypti* was in 1945. This may be because *A. albopictus* is still found in situations well away from human dwellings, as well as in the domestic locations formerly occupied by *A. aegypti*.

The distribution records of *A. subpictus indefinitus* from the present survey do not add any significant data. Larvas were found from the central part of the island to the southern tip. *Anopheles* larvas were occasionally very numerous in ground pools. In a marshy area at Umatac, *Anopheles* larvas were estimated at over 100 per dip. *C. annulirostris marianae* and *A. vexans nocturnus* larvas were taken from the same marsh, but in much lesser numbers.

(8) Reeves, W. C., and Rudnick, A.: Survey of mosquitoes of Guam in two periods in 1948 and 1949 and its epidemiological implications. Am. J. Trop. Med. 31: 633-658, Sept. 1951.

TABLE 2. *Number of larval collections, by species, in the common types of breeding places, 1951 survey*

Breeding place	*Aedes albopictus*	*Anopheles subpictus indefinitus*	*Culex quinque-fasciatus*	*Aedes vexans nocturnus*	*Aedes guamensis*	*Aedes pandani*	*Aedes oakleyi*	*Culex annuli-rostis marianae*	*Culex litoralis*
Rain barrel	38		23		1			4	
Tire	36	1	28		8		4	3	
Tin can	11		8		2			1	
Other metal container	14		8		1			3	
Ground pool	2	10	6	12				9	
Tree hole	5				2				
Cut bamboo hole	5				2				
Plant-leaf axil					1	3			
Coral rock-hole		3		1				1	9
Miscellaneous	6		4					1	

TABLE 3. *Distribution of mosquito species on Guam, 1951 survey*

	Aedes albopictus	*Anopheles subpictus indefinitus*	*Culex quinque-fasciatus*	*Aedes vexans nocturnus*	*Aedes guamensis*	*Aedes pandani*	*Aedes oakleyi*	*Culex annuli-rostris marianae*	*Culex litoralis*
Tarague Beach			+		+				+
Anderson Air Force Base	+		+		+				
AGAFO Gumas (near Potts Junction)	+		+					+	
Hilaan Point				+				+	+
Pagat Point		+							+
Mt. Santa Rosa	+							+	
Yigo	+		+		+				
Dededo District	+		+	+		+			
Tumon Bay	+		+					+	
Naval Hospital	+		+		+	+		+	
Barrigada	+		+		+				
Mongmong	+	+	+		+			+	
Toto	+		+						

TABLE 3. *Distribution of mosquito species on Guam, 1951 survey*—Continued

	Aedes albopictus	*Anopheles subpictus indefinitus*	*Culex quinque-fasciatus*	*Aedes vexans nocturnus*	*Aedes guamensis*	*Aedes pandani*	*Aedes oakleyi*	*Culex annuli-rostris marianae*	*Culex litoralis*
Tamuning	+		+					+	
Agana	+		+				+	+	
Sinajana	+		+					+	
Ordot	+		+	+	+	+			
Coontz Junction	+		+						
Asan	+		+						
Piti	+		+						
Agat Bay area	+		+	+				+	
Orote Point	+								
Apra Harbor area								+	
Santa Rita	+								
Nimitz Beach	+	+	+	+				+	
Cetti Bay area	+		+					+	
Mt. Lamlam	+	+				+			
Chalon Pago	+	+	+	+				+	

TABLE 3. *Distribution of mosquito species on Guam, 1951 survey*—Continued

	Aedes albopictus	*Anopheles subpictus indefinitus*	*Culex quinquefasciatus*	*Aedes vexans nocturnus*	*Aedes guamensis*	*Aedes pandani*	*Aedes oakleyi*	*Culex annulirostris marianae*	*Culex litoralis*
Yona	+	+	+		+				
Ylig Bridge			+						
Togcha Bay	+		+		+				+
Talofofo	+		+						
Inarajan	+	+		+	+	+		+	
Merizo		+		+					
Umatac	+	+	+	+		+		+	+

A. pandani, which breeds in pandanus and taro leaf axils, was taken only 3 times in the larval stage. A detailed search for *A. pandani* larvas was not undertaken because *A. aegypti* larvas are not usually found in the same breeding places. *A. guamensis* larvas were taken once with *A. pandani,* however, from a taro leaf axil. In spite of the few larval collections of *A. pandani,* it was found to be very numerous because adults were encountered biting persistently on many occasions. They were probably more numerous than any other species on the island during the time of this survey. Pandanus plants are to be found wherever any extensive jungle growth exists.

A. oakleyi, a rare container-habitat breeder, was found only 4 times, each time from the same abandoned truck tire in Agana. *C. litoralis,* a coral rock-hole breeder, was found a few times, once with *Anopheles* larvas in the same hole. *C. sitiens,* another coral rock-hole breeder recorded previously from Guam, was not found in this survey.

Only 6 adult biting collections were made. Two of these were made during the day in jungle areas, where only *A. pandani* and *A. albopictus* were taken. Four other collections were made during the early evening, 1 at a marsh at Umatac where *Anopheles* larvas had been found and 3 at Inarajan, again where *Anopheles* larvas had been found nearby. In these 4 night collections, however, *A. pandani, A. albopictus, A. vexans nocturnus,* and *C. annulirostris marianae* were taken, but no *Anopheles.*

It was hoped that *Anopheles* could be taken while biting. Reeves and Rudnick (7) were able to attract *Anopheles* adults to animal but not to human bait traps. During the present survey, 2 out of 3 reared female *Anopheles* in a small cage in the laboratory were induced to engorge on my arm.

No autochthonous malaria is known on Guam at present. *A. subpictus indefinitus* is fairly numerous in the Philippine Islands. It will feed on man or animals there, but it is not considered a malarial vector (9). It would seem likely that *A. subpictus indefinitus* was introduced into Guam from the Philippines, although nobody has offered proof of this. *A. subpictus* has 2 other subspecies, and the geographic distribution of the 3 subspecies has not been completely worked out (10). *A. subpictus indefinitus* occurs also in Formosa (9) and Malaya (10). An undetermined subspecies of *A. subpictus* is a vector of malaria in the Celebes and in Madoera, a small island off Java. It is thought likely

(9) Russell, P. F.; Rozeboom, L. E.; and Stone, A.: Keys to the Anopheline Mosquitoes of the World With Notes on Their Identification, Distribution, Biology, and Relation to Man. Prepared for the Preventive Medicine Division, Office of the Surgeon General, U. S. Army. American Entomological Society, Academy of Natural Sciences, Philadelphia, Pa., 1943.

(10) Farner, D. S., et al.: Distribution of Mosquitoes of Medical Importance in the Pacific Area. Navmed P-983. Bureau of Medicine and Surgery, Navy Dept., Washington, D. C., 1946.

that *A. subpictus indefinitus* is the subspecies present on Java *(10)* and, if so, presumably also on Madoera. Thus, it seems possible that *A. subpictus indefinitus* may be a vector of malaria in some areas.

The southeastern areas on Guam where *Anopheles* were found in the greatest numbers are well removed from present Armed Forces installations. This alone is not of any real significance in preventing malaria, however, because service personnel may visit any part of the island during the evening hours. The continued absence of malaria on Guam in the presence of an *Anopheles* mosquito species can probably be ascribed to the fact that *A. subpictus indefinitus* has not been found to bite man naturally on Guam and that its role as a malarial vector in other areas is questionable or negative, even where it is known to feed on human blood.

SUMMARY

During a mosquito survey made on Guam in 1951, no *A. aegypti* adults or larvas could be found. This and other recent work indicates that *A. aegypti,* numerous before 1945, may have been eradicated. *A. albopictus,* a mosquito of similar habits and vector potentialities, seems to have taken the place of *A. aegypti.* An *Anopheles* species, first found on Guam in 1948, was found to be maintaining itself successfully. From evidence gathered during this survey, and from other sources, the *Anopheles* species present does not seem to constitute a threat as a malarial vector. A total of 9 species of mosquitoes were collected and their distribution on Guam is reported.

BOOKS RECEIVED

International Sanitary Regulations, Proceedings of the Special Committee and of the Fourth World Health Assembly on WHO Regulations Number 2. Official Records of the World Health Organization Number 37. 443 pages. World Health Organization, Geneva, Switzerland, publisher, 1952. Price $2.25.

The 1951 Year Book of Pathology and Clinical Pathology (January-December 1951). Pathology, edited by *Howard T. Karsner,* M. D., LL. D., Medical Research Advisor to the Surgeon General, United States Navy; Clinical Pathology, edited by *Arthur Hawley Sanford,* M. A., M. D., Emeritus Professor of Clinical Pathology, Mayo Foundation; Emeritus Consultant, Division of Clinical Laboratories, Mayo Clinic; Director of Laboratories, Rochester State Hospital. 454 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., 1952. Price $5.50.

Pathology of the Cell, by *Gordon Roy Cameron,* M. B., D. Sc. (Melb.), F. R. C. P., F. R. S., Director of the Graham Research Laboratories and Professor of Morbid Anatomy at University College Hospital Medical School in the University of London. 840 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1952.

The Unipolar Electrocardiogram, A Clinical Interpretation, by *Joseph M. Barker,* M. D., F. A. C. P., Cardiologist, Yater Clinic; Associate Professor of Clinical Medicine and Special Lecturer in Physiology, Georgetown University School of Medicine; Director of the Heart Station and Visiting Physician, Georgetown University Hospital; Chief of Cardiology, Providence Hospital; Visiting Physician, Gallinger Municipal Hospital; Consulting Cardiologist, Arlington Hospital, Arlington, Va.; Assisted by *Joseph J. Wallace,* M. D., F. A. C. P., Advised by *Wallace M. Yater,* M. D., F. A. C. P., Foreword by *Frank N. Wilson,* M. D., F. A. C. P. 655 pages; illustrated. Appleton-Century-Crofts, Inc., New York, N. Y., publisher, 1952.

Practical Pharmacology, by *J. H. Burn,* Professor of Pharmacology, University of Oxford. Illustrations by *E. M. Vaughan Williams.* 72 pages; illustrated. Blackwell Scientific Publications, Oxford, England, publisher, 1952. Published simultaneously in the United States by Charles C Thomas, Publisher, Springfield, Ill., 1952. Price $3.25.

Reaction to Injury, Pathology for Students of Disease. Volume II, The Reactions of Submission and Adaptation and the Disease Entities Arising Out of Their Elaboration, by *Wiley D. Forbus,* M. D., Professor of Pathology, Duke University; Pathologist to the Duke Hospital. 1,110 pages; 836 illustrations; 54 in color. The Williams & Wilkins Co., Baltimore, Md., publishers, 1952. Price $20.

Principles and Practice of Anesthesiology, by *Vincent J. Collins,* M. D., Director of the Department of Anesthesiology at St. Vincent's Hospital of the City of New York. 528 pages; 99 illustrations. Lea & Febiger, Philadelphia, Pa., publishers, 1952. Price $10.

Ego Development and the Personality Disorders, A Developmental Approach to Psychopathology, by *David P. Ausubel,* M. D., Ph. D., Bureau of Research and Service, College of Education, University of Illinois, Urbana. 564 pages. Grune & Stratton, New York, N. Y., publishers, 1952. Price $10.

Ambulatory Proctology, by *Alfred J. Cantor,* M. D., Proctologist, Kew Gardens General Hospital, Long Island, N. Y.; Formerly Assistant Attending Gastroenterologist, Queens General Hospital; Assistant Adjunct Proctologist, Hospital for Joint Diseases, New York. Foreword by *Beaumont S. Cornell,* M. D., Editor, American Journal of Digestive Diseases. 2d edition, revised. 563 pages; 382 illustrations. Paul B. Hoeber, Inc., New York, N. Y., publisher, 1952. Price $10.

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Blakiston's Illustrated Pocket Medical Dictionary, Edited by *Norman L. Hoerr,* M. D., and *Arthur Osol,* Ph. D., with the Cooperation of an Editorial Board. 1029 pages; 60 illustrations, 16 in color, on 24 plates. The Blakiston Co., New York, N. Y., publisher, 1952. Price $3.75.

Vascular Diseases in Clinical Practice, by *Irving Sherwood Wright,* M. D., Professor of Clinical Medicine, Cornell University Medical College; Attending Physician, The New York Hospital. 2d edition. 552 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., 1952. Price $8.50.

Some Practical Clinical Aspects Of Leprosy

John A. C. Gray, *Captain, MC, U. S. N.* (1)

OF the great infectious diseases of mankind, that probably least known to the American physician is leprosy. Confined largely to the tropics and to areas where hygienic conditions are poor, leprosy is seldom seen by the practitioner in the continental United States. Nevertheless, a disease which affects about 5,000,000 human beings (2) cannot be allowed to fall into the professional subconscious, especially when increasingly rapid travel about the globe brings it within hours or days of North America. It is particularly important to the military physician who may find himself overnight in an endemic area. Therefore some clinical observations, based on 21 personally observed cases of leprosy, are offered in the hope that they may be of practical use.

THE PATIENTS

The patients were seen within a period of 2 years in American Samoa, a United States territory with which there is frequent communication from Hawaii, the continental United States, Fiji, and New Zealand, and in which the morbidity is currently calculated to be 1.91 per thousand (3). The basic data regarding the patients are set forth in table 1.

With the exception of 2 patients of known mixed Samoan-European parentage, all of the patients were Polynesians (Europoids) (4). There were 12 male and 9 female patients in the group. Infection may be ascribed to household contact in 11 cases and to known association with other patients in 9. In only 1 instance (case 13) was it impossible to show a reasonable explanation of the infection.

• (1) U. S. Naval Dispensary, Department of the Navy, Washington, D. C.

(2) Rogers, L., and Muir, E.: Leprosy. 3d edition. William Wood & Co., Baltimore, Md., 1946. p. 49.

(3) Annual Report, Public Health Department of American Samoa, 1951.

(4) Buck, P. H.: Vikings of the Sunrise. Frederick A. Stokes Co., New York, N. Y., 1938. p. 16.

The available facts regarding the onset are shown in table 2. The figures show that leprosy is a disease of youth, that lesions of the skin are the most common complaints of the patients, and that the goal of early recognition is far from achieved.

TABLE 1. *Data regarding patients (listed in order of admission to hospital)*

Case number	Age (years)	Sex	Race	Type of disease	Positive tests
1	60	F	Half-caste	Tuberculoid	-
2	22	M	Polynesian	Tuberculoid	-
3	23	M	Polynesian	Lepromatous	D
4	22	F	Polynesian	Tuberculoid	B
5	13	F	Polynesian	Lepromatous	N,D,B
6	23	M	Polynesian	Tuberculoid	B
7	17	F	Polynesian	Lepromatous	D,B
8	15	F	Polynesian	Lepromatous	D,B
9	26	F	Polynesian	Lepromatous	N,D,B
10	13	M	Polynesian	Lepromatous	B
11	17	M	Polynesian	Lepromatous	D,B
12	15	M	Polynesian	Tuberculoid	B
13	26	M	Polynesian	Tuberculoid	B
14	15	M	Polynesian	Tuberculoid	-
15	40	F	Half-caste	Indeterminate	D,B
16	26	M	Polynesian	Lepromatous	N
17	36	F	Polynesian	Lepromatous	N
18	44	M	Polynesian	Tuberculoid	N
19	16	F	Polynesian	Lepromatous	N
20	13	F	Polynesian	Tuberculoid	N
21	11	M	Polynesian	Indeterminate	N

N = positive nasal smear.
D = positive dermal smear.
B = positive biopsy.

In 4 instances the duration of symptoms is described as indefinite because it was impossible to set an approximate date of onset. An example is the following case.

Case 18. A 44-year-old man complained of general tiredness of the lower extremities. The tissues of his face and ears were slightly thickened and the lateral thirds of his eyebrows were missing. There was a large area of atrophic skin over his right clavicular region with a raised, finely nodular border. His auricular and ulnar nerves were as

TABLE 2. *Data regarding onset*

Age when diagnosed (years)		Reason for observation		Duration of symptoms	
Age group	Cases	Reason	Cases	Time	Cases
10-14	4	Dermatosis	12	Under 1 month	5
15-19	6	Sluggish ulcers	4	1-12 months	5
20-29	7	Coincident disease	2	Over 1 year	6
Over 30	4	Routine examination	3	Onset in hospital	1
				Indefinite	4

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large as lead pencils, and the former were visible when he turned his head. There was anesthesia to pain in the distribution of his left lateral peroneal nerve. His nose was congested, and nasal smear showed many acid-fast bacilli. From the extent of his lesions it was obvious that he had had tuberculoid leprosy for some time, but it was impossible to say for how many years (fig. 1).

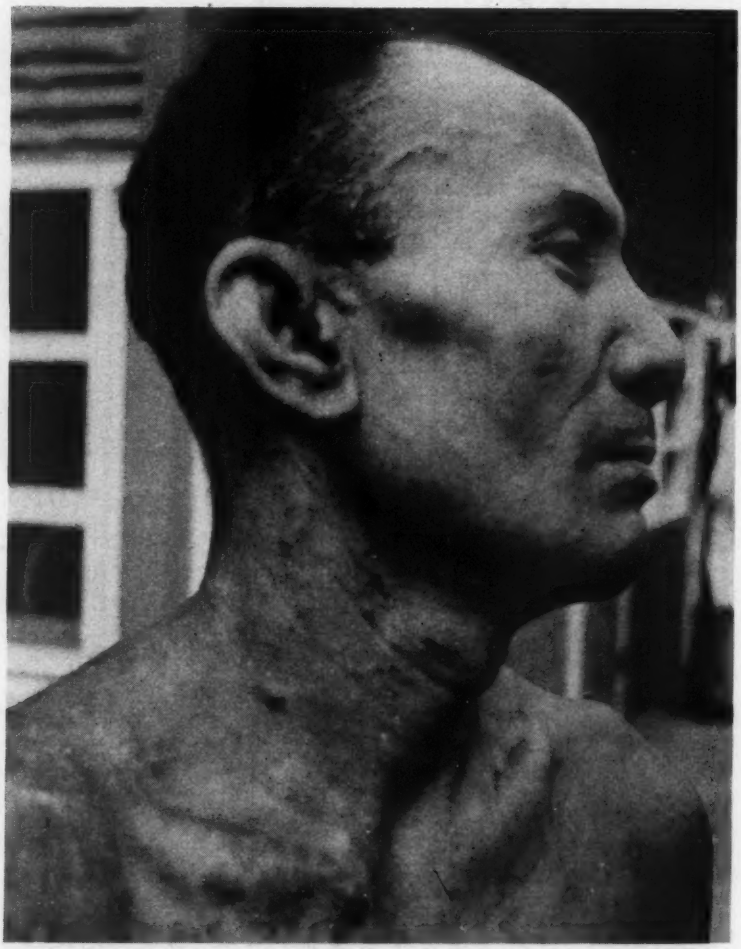

Figure 1. (case 18). Tuberculoid leprosy. Note loss of the lateral one-third of the eyebrow and a large, atrophic area of skin in the right clavicular region. On close inspection, the enlarged auricular nerve may be seen.

By contrast, another case which became clinically recognizable in the hospital was of great interest.

Case 12. A boy of 15 was hospitalized because of classical subacute bacterial endocarditis, engrafted on rheumatic heart disease characterized by mitral stenosis and insufficiency. On the twentieth hospital day, while responding to massive penicillin therapy, raised, red, pruritic, anesthetic lesions appeared on his right arm. These spread to involve the entire right arm and forearm, and were accompanied by edema and axillary lymphadenitis. Similar lesions appeared above his left elbow. A biopsy specimen of skin from a lesion showed evidence of tuberculoid leprosy. In the light of this extraordinary coincidence, the situation was reviewed, but no reason was found to change the admission diagnosis. It seemed likely that the subacute bacterial endocarditis lowered the patient's resistance to a subclinical leprosy.

PHYSICAL SIGNS

The most common physical findings on original physical examination were a fixed dermatosis, enlarged peripheral nerve trunks, and a congested nose. These phenomena follow from the fact that *Mycobacterium leprae* confines its pathogenic activities largely to the skin, peripheral nervous system, and upper respiratory tract. Details regarding findings on initial examination are presentedin table 3.

TABLE 3. *Findings on original examination*

Location	Sign	Number of patients
General systemic	Fever	4
Skin	Thickening	9
	Nodulation	7
	Erythema	6
	Macules	5
	Ulcers	5
	Edema	5
	Annular lesions	3
	Alopecia	2
	Scaling	1
Nerves	Enlarged trunks	8
	Anesthesias	7
	Lower motor neuron paralysis	2
	Hyperesthesia	1
Nose	Congestion	7
	Epistaxis	2
Lymphatics	General lymphadenopathy	4
	Regional lymphadenopathy	2

From a few recorded cases of leprosy in which the portal of entry is probably known (5), it may be inferred that the disease begins with a primary lesion at the site of inoculation, and that this is followed by a lymphohematogenous spread. The result in the individual patient is largely dependent on his powers of resistance. Some patients impose little restraint on the bacilli and develop what is known as the lepromatous form of leprosy. Others, having a higher resistance, develop

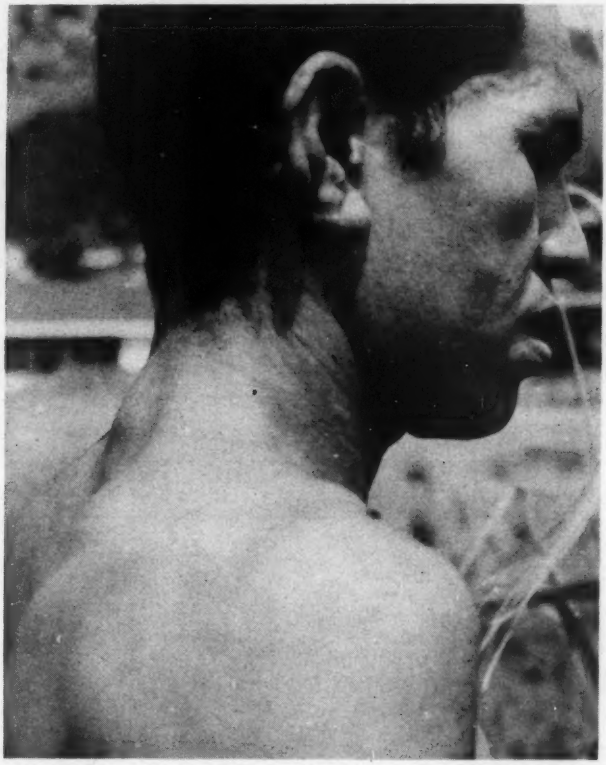

Figure 2. (case 16). Lepromatous leprosy. Note thickening of the skin in the periorbital, malar, and shoulder areas and thickening and nodulation of the ear. Note mouth breathing.

the tuberculoid form. In still others, a clear-cut type may not emerge until after a long time, if ever. These are said to suffer from an indeterminate type of leprosy. The differences between these general groups will be indicated below.

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(5) See footnote reference (2). pp. 89-91.

General systemic events. In general, leprosy is a disease accompanied by little or no toxicity. There are, however, events in the course of the disease known as reactions, during which the patient is acutely ill. In lepromatous leprosy the reaction is febrile and the patient is seriously and, at times, fatally ill. The tuberculoid reactions are characterized by exacerbation of skin lesions and neuritis. In both instances, the reactions suggest attempts at healing. In lepromatous leprosy the reaction is abortive, but in tuberculoid leprosy a reaction may actually be a good prognostic sign.

The skin lesions in leprosy are due to an actual bacterial dermatitis, whether localized or widespread. Lepromatous leprosy, in which the dermatitis is widespread, is unique among dermatitides in that billions of bacilli may exist in the skin in an almost saprophytic condition for a long time. As in any dermatitis, redness, heat, and swelling may be expected with the onset, with exacerbation, or with inflammatory response on the part of the host. The bacteria proliferate and the lesions grow in size as masses of bacilli are engulfed, but not destroyed, by phagocytic lepra cells. Visible, raised tumefactions, known as lepromas, appear (fig. 2).

The more intense the inflammation, the redder the lesion. Ulceration may occur with extrusion of the focus. A change from a red to a brown color denotes declining activity, and ultimately the tumors become pale and flat, suggesting quiescence.

In tuberculoid leprosy, on the other hand, the patient, having a higher power of resistance, localizes the invading organisms from the start, and a single or a relatively few lesions result. Characteristically these are asymmetrical in distribution. A progressing lesion is more or less annular and presents a raised, nodular, active border and a flat, atrophic center (fig. 1).

The peripheral nervous system. Myco. leprae induces neuritis by invading and causing reaction in the connective tissue stroma of peripheral nerves. To this is due the clinically perceptible enlargement, best appreciated where a nerve trunk passes close to the surface over a solid substructure (fig. 1). The chief signs of the neuritis are anesthesia and lower motor neuron paralysis distal to the lesion. Severe neuralgia may occur during an inflammatory reaction. Marked nerve involvement can produce gross deformities, such as extensor paralysis of the fingers or facial paralysis. Such lesions are especially prominent in tuberculoid leprosy, but may occur to a lesser degree in the lepromatous type. They may leave the patient a cripple, unable to care for himself, long after he has ceased to be a menace to the public health.

The respiratory mucosa. In the nasal mucosa, *Myco. leprae* causes congestion with or without ulceration and nosebleed. From the nose the process may spread directly to the pharynx, larynx, and trachea. Ex-

haled bacilli are probably a source of infection. The breathing heard in nasal leprosy resembles that in hypertrophic rhinitis.

The lymphatics. Enlargement of the regional lymph nodes usually accompanies infection of the skin. The more general the infection, the more generalized the lymphadenopathy. The extent of lymph node enlargement noted in leprosy is roughly in proportion to the thoroughness of the physical examination. Lymphadenitis may obstruct drainage and cause edema distal to the involved nodes.

Other clinical phenomena, which we have not observed but which are not uncommon, are ophthalmitis, and testicular atrophy due to orchitis and accompanied by secondary eunuchoidism. In lepromatous leprosy bacterial invasion of the globe causes inflammatory destruction of the eye. In tuberculoid leprosy the eye may be damaged as a result of eyelid paralyses.

LABORATORY DATA

Ordinarily, the diagnosis of leprosy is made on the basis of the physical examination alone. Often, however, recourse is had to the laboratory for aid in differential diagnosis and in classification. The examinations made in our patients were nasal smears, dermal smears, and biopsies. Roentgenograms may at times define trophic bone changes. Other tests, such as urinalysis and blood count, are of use only when normal values are altered by complications, intercurrent disease, or therapeutic misadventure.

Nasal smear. Scrapings are taken from septal or turbinate lesions and stained for acid-fast bacilli. A positive result is not pathognomonic because tubercle bacilli or saprophytes may be found in the nose. Clumps of acid-fast bacilli arranged in bundles like cigars are, however, confirmatory evidence of a clinical diagnosis of leprosy.

Tissue smear. A slit is made in a suspected lesion and the juice smeared, or, preferably, a bit of tissue is excised and macerated on a slide. The finding of acid-fast bacilli in such a preparation can mean only leprosy, provided tuberculosis cutis and the new mycobacterial infection described by various authors (6-9) can be eliminated.

Biopsy. A section of a skin lesion or of a lymph node is removed and stained for acid-fast bacilli and histologic study. The presence of acid-fast bacilli has the same significance as their presence in a dermal smear. In the hematoxylin-eosin preparation, large foamy lepra

(6) MacCallum, P.: New mycobacterial infection in man; clinical aspects. J. Path. & Bact. 60: 93-102, Jan. 1948.

(7) Tolhurst, J. C., and Buckle, G.: New mycobacterial infection in man; experimental investigations in laboratory animals. J. Path. & Bact. 60: 102-110, Jan. 1948.

(8) Sissons, H. A.: New mycobacterial infections in man; pathology of experimental lesions in rat. J. Path. & Bact. 60: 110-116, Jan. 1948.

(9) Buckle, G., and Tolhurst, J. C.: New mycobacterial infection in man; cultivation of new mycobacterium. J. Path. & Bact. 60: 116-122, Jan. 1948.

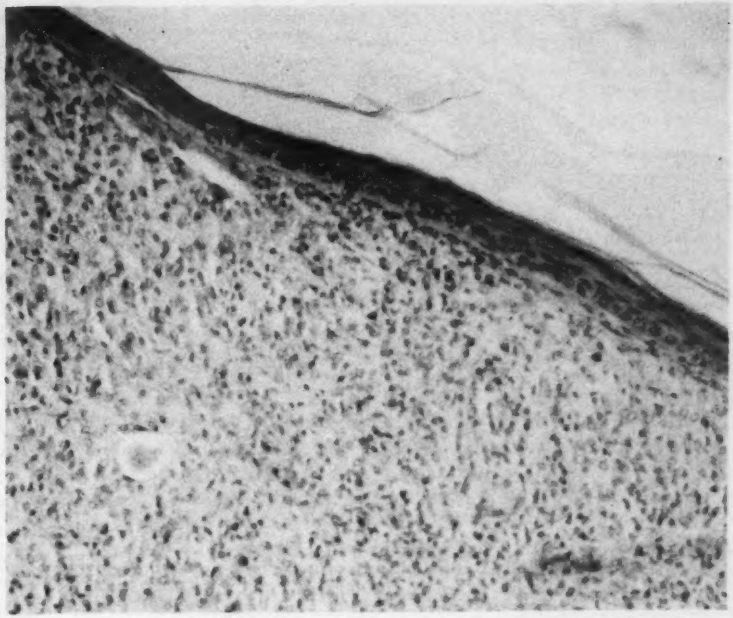

Figure 3. (case 8). Lepromatous leprosy. Section of a leproma on the ear showing flattened, thin epidermis. The tissue consists mostly of lepra cells. There were so many bacilli present that in the acid-fast stain daubs of red color could be seen with the low-power objective. (This section included by courtesy of Tripler General Hospital, Honolulu, T. H.)

cells are diagnostic of lepromatous leprosy (fig. 3). Epithelioid cells and tubercles, in the absence of tuberculosis cutis, mean tuberculoid leprosy (fig. 4). A general round-cell infiltration of the granuloma type, with neither lepra cells nor tubercles, is nonspecific, but supports a clinical diagnosis of uncharacteristic or indeterminate leprosy.

The laboratory findings in these patients are shown in table 4.

DIAGNOSIS

Leprosy is one of the most easily recognized of diseases provided its existence is not forgotten. There is nothing else which causes the combination of fixed dermatosis, peripheral neuritis, and nasal obstruction, with or without lymphadenopathy and fever. Unfortunately, the most easily recognized case is the far-advanced case. The public health and clinical refinement demand earlier detection. To this end a suspicious-minded examiner and a painstaking physical examination are necessary because there is no known biologic or mechanical screening test. The procedures listed in table 5 should be followed as a matter of routine. Good illumination by sunlight is essential for observation of skin lesions.

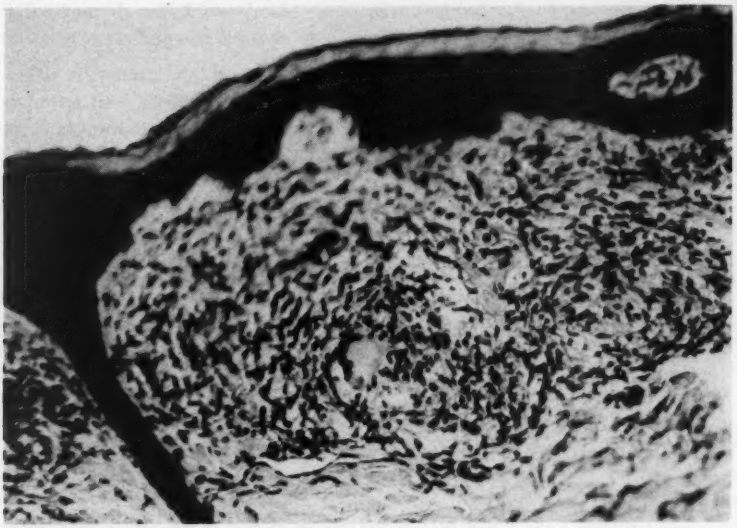

Figure 4. (case 13). Tuberculoid leprosy. Section of a solitary, transitory lesion. Many epithelioid cells and round cells are present. Note giant cell to the left of the center.

These procedures are described as minimal because positive or suggestive findings will naturally lead to further investigations, such as anterior rhinoscopy or tests of sensation.

The differential diagnostic problems encountered in our patients included erythema multiforme, chronic ulcers, and epistaxis.

Erythema multiforme

Three patients were believed to have this nonspecific entity at original examination.

Case 4. A 22-year-old woman had had raised, red lesions all over her body for about 2 weeks prior to admission. Leprosy was considered as a possibility, but a diagnosis of erythema multiforme was made when nasal and dermal smears were reported to be negative. She had actually been discharged from the hospital and had to be recalled when a delayed report of the biopsy specimen which indicated leprosy was received.

Case 9. A highly intelligent 26-year-old woman was admitted because of fever and a generalized skin rash of 8 days' duration. She had many raised, red, macular lesions, each several centimeters in diameter, which showed a tendency to confluence. A diagnosis of erythema multiforme was made. A typhoid-like temperature curve, increasing nasal congestion, and several nosebleeds led to re-evaluation

and recognition of her lepromatous leprosy, confirmed by nasal and dermal smears and biopsy. When she learned the diagnosis, she volunteered the information that she had had no feeling on the lateral aspect of her left leg for 2 years. After several weeks of high fever and severe prostration, she recovered slowly from the acute lepra reaction.

TABLE 4. *Laboratory findings in 21 cases of leprosy*

Test	Number positive	Number negative	Total
Nasal smear	8	5	13
Dermal smear	7	2	9
Biopsy	11	0	11

Case 17. A 36-year-old housewife was diagnosed by a public health official when she was about to board an outbound ship at Pago Pago. She had facial and aural thickening and erythema, and her entire skin felt irregular because of numerous subcutaneous nodules. Three years previously she had been observed in the hospital as a leprosy suspect, but had been discharged with diagnosis of erythema multiforme because all tests were reported to be negative. In the meantime, her brother and her oldest son (cases 11 and 16) had been admitted to the hospital with leprosy, she had borne 2 children, and had moved to a hitherto unexposed village.

TABLE 5. *Minimal physical examination for leprosy*

Method	Area	For
Inspection	Face and ears	Thickening, redness, nodulation, atrophy, dermatosis, alopecia
	Neck (head rotated)	Enlarged auricular nerves
	Trunk and extremities	Dermatosis, erythema, ulcers, edema, enlarged nerve trunks
	Digits	Loss, ulceration, deformity
Palpation	Skin	Confirmation of visible lesions; subcutaneous nodules
	Lymph nodes	Lymphadenopathy
	Nerve trunks	Enlargement
Audition	Nose	Obstructed, noisy respiration

The only possible explanation for this original error was faulty technic in the procurement of specimens or in the laboratory, plus the blind faith of the physicians in laboratory reports. Erythema multiforme in the United States may be due to focal infection, tuberculosis, or other causes. In American Samoa during the past 2 years, with the exception of 1 case of erythema iris due to sulfadiazine intoxication, it has regularly been due to leprosy.

Chronic ulcers

There were 4 cases with this presenting symptom.

Case 10. A boy of 13 complained of a sore on his right heel of several months' duration. Examination showed erythematous cheeks, nasal congestion, thickened peripheral nerve trunks, generalized lymphadenopathy, clawhand, glove-and-stocking anesthesia, ulcers on the fingers, a large ulcer on the right heel, and surgical absence of the right middle finger. Three years previously this finger had been amputated because of "bone degeneration and deformity."

Case 20. Habitually barefoot, this 13-year-old girl was accustomed to minor injuries on her feet, but when some cuts failed to heal after several weeks, she sought advice. The tissues of her face and nose were thickened, her nose obstructed, her ulnar and auricular nerves thickened, and her hands and feet insensitive to pain and light touch. There were several linear, oozing lacerations on the soles of her feet. The diagnosis was tuberculoid leprosy. This girl had been in the hospital about 6 months previously because of severe epistaxis. This epistaxis was probably the first presenting symptom.

Cases 14 and 19 were found to have leprosy when examined because of the sluggish healing of minor burns.

Epistaxis

The possible significance of epistaxis as a differential diagnostic problem in leprosy is indicated in cases 9 and 20 above.

CLASSIFICATION

The classification of the type of leprosy in the individual patient is important from the point of view of prognosis and of the public health. A patient with minor lesions, containing a few bacilli, and having a high natural resistance is evidently a good risk, whereas a patient with many lesions rich in bacilli and poor resistance is a poor risk.

The ideal method of classification is by means of the lepromin test *(10)*. This intradermal reaction to killed lepra bacilli indicates the resistance of the patient, a strong reaction meaning strong resistance, and no reaction poor resistance, corresponding respectively to the tuberculoid and the lepromatous forms of the disease. Unfortunately, an attempt to manufacture lepromin was unsuccessful, owing to lack of suitable material. Hence, in our cases classification *(11)* had to be based on clinical, bacteriologic, and pathologic findings only. The chief considerations are shown in table 6.

The indeterminate case occupies an intermediate position in this rough scheme, except that neither lepra cells nor tubercles can be found in tissue sections.

(10) Muir, E.: Manual of Leprosy. Williams & Wilkins Co., Baltimore, Md., 1948. p. 23.
(11) See footnote reference *(10)*. p. 29.

Two examples of good risk cases follow:

Case 6. A man, aged 23 years, came to the hospital because of skin lesions which he had had for about 2 years. He was a prisoner at the time and his visit may have been conditioned on a hope that he would be transferred from the jail to the hospital for he was in robust general health. He presented about 20 large, annular, erythematous lesions with raised borders and flat centers on the trunk and extremities. The lesions were hypesthetic. A biopsy specimen showed no bacilli in the acid-fast stain, but microscopic tubercles were present. After 6 months in the hospital with insufficient treatment to effect a cure, he had just perceptible lesions and, 1 year after discharge, none at all.

TABLE 6. *Nonimmunologic basis for classification of leprosy (11)*

Consideration	Lepromatous type	Tuberculoid type
Skin lesions	Symmetrical Nodular Center elevated Border not sharp	Asymmetrical Annular Border elevated Border well demarcated
Nerve lesions	Minor	Major
Bacilli on dermal smear or section	Abundant	Few or absent
Histology	Lepra cells	Tubercles and epithelioid cells

Case 13. A 26-year-old man sought advice because of a single lesion on the calf of his right leg. Although he denied other symptoms, his superiors stated that he was not at the time doing the work of which he was known to be capable. He had 1 oval lesion, about 20 by 30 cm. in extent, with a raised, finely nodular border and a flat, anesthetic, atrophic center. A biopsy specimen was diagnostic of tuberculoid leprosy (fig. 4). With minimal outpatient treatment, the single lesion cleared, and 18 months later there was no evidence of local or systemic disease except for the persistence of anesthesia. Were it not for the biopsy specimen and the anesthesia, the diagnosis would be open to question.

There is reason to believe that there are many of these self-arresting cases of minor tuberculoid leprosy which never come to the attention of a physician. They are important because they indicate the apparent benignity of the disease in some patients. They are considered to be "apparently benign" because it is impossible to state what their future will be. Case 9 illustrates the fact that a patient with a solitary nerve lesion may later develop florid, lepromatous leprosy.

TREATMENT

The treatment of leprosy belongs in the hands of experts. As the Hospital of American Samoa has no more than the facilities of a receiving center for leprosy patients, and no leprologist is attached, only the most general comments on therapy are appropriate here. The physician must take into account both the public health and the welfare of the patient. The public health demands isolation of the infectious patient. The welfare of the patient requires understanding of his problem as a human being as well as active therapy. In order to achieve both ends, we have evolved a plan of management which seems suited to local conditions. It will undoubtedly be modified with the passage of time.

The lepromatous patient is isolated at once and transferred as soon as possible (in the South Pacific transportation may be available only once a year) to the Central Leper Hospital, Makogai, Fiji, which is the leprosarium of the region, where definitive treatment is available. Transfer is considered to be obligatory because of the infectivity of lepromatous leprosy and because, at best, years may be required to effect arrest.

The tuberculoid patient, as well as the indeterminate patient, is individualized as to infectivity, prognosis, and sociologic status. If infectivity is probable on bacteriologic grounds, or prognosis suggests the need of prolonged treatment, the patient is transferred to the leprosarium. Sociologically, patients incapacitated by paralyses, or children who deserve schooling and a relatively normal atmosphere during treatment, are also candidates for the leprosarium. Fortunately, only 1 of our patients (case 2) fell into the former category. Some patients with tuberculoid leprosy who are deemed slightly infectious, if at all, and who do not require protection for sociologic reasons, are released to outpatient status.

Whatever plan of management is adopted, consistency is essential for success. Not only is procrastination cruel to the patient, but it is impossible to rally public sentiment around control measures which lead one way today and another tomorrow.

Once diagnosed, the patient should receive immediate, albeit nondefinitive, treatment. The situation and the prognosis should be explained, and any necessary isolation made as easy as possible by means of occupational therapy and a friendly relation between patient and attendants. A nutritious diet, outdoor exercise, and any available recreation are presupposed. Visits by relatives and friends and by the clergy, subject only to reasonable precautions, are to be encouraged. The atmosphere created about the patient should be one of purposeful and hopeful treatment of a chronic disease, exactly analogous to the atmosphere in a well-managed tuberculosis sanatorium.

Drug treatment in our hands consisted of using sulfoxone sodium and streptomycin. Because in no patient was treatment carried to completion, it may only be observed that some benefit occurred in 10 of the 14 patients receiving the former. The first improvement noted was decrease in nasal congestion; the second, subsidence of skin lesions. Two severe reactions were due to poor therapeutic judgment rather than to the drug. Sulfoxone sodium is not a foolproof drug. Streptomycin was used with inconclusive results in 2 patients.

INTERCURRENT DISEASES

Among intercurrent diseases, 1 instance of acute appendicitis (case 19) and 3 of periapical dental abscess (cases 16, 17, and 18) were encountered. All were treated successfully by appropriate operation.

SUMMARY

The most common physical findings in 21 patients with leprosy in American Samoa were a dermatosis, enlarged peripheral nerve trunks, and nasal congestion. Leprosy should be considered whenever these findings are seen, especially if they are of long standing, and in patients with apparent erythema multiforme, chronic ulcers or epistaxis. A tuberculoid, indeterminate, and lepromatous form of the disease are recognized. Definitive treatment should be left to the expert.

BOOKS RECEIVED

Text-Book of Ophthalmology, by *Sir Stewart Duke-Elder,* K. C. V. O., M. A., LL. D., D. Sc. (St. And.), Ph. D. (London), M. D., F. R. C. S., Hon. D. Sc. (Northwestern), D. M. (Utrecht), F. R. C. S. (Edin), F. A. C. S., Surgeon Oculist to H. M. The King; Knight of Grace, Order of St. John; Consulting Ophthalmic Surgeon to the British Army and the Royal Air Force; Fellow, University College, London; Director of Research, Institute of Ophthalmology, University of London; Honorary Consulting Surgeon, Moorfields Westminster and Central Eye Hospital; Ophthalmic Surgeon, St. George's Hospital, London. Volume V, The Ocular Adnexa. 5713 pages, 1181 illustrations, 32 in color. The C. V. Mosby Co., St. Louis, Mo., publisher, 1952.

The Toxemias of Pregnancy, by *William J. Dieckmann,* S. B., M. D., Mary Campau Ryerson Professor and Chairman of the Department of Obstetrics and Gynecology of the University of Chicago; Chief of Service of The Chicago Lying-in Hospital and Dispensary; Attending Gynecologist, Albert Merrit Billings Memorial Hospital of the University of Chicago; Associate Editor of the American Journal of Obstetrics and Gynecology. 2d edition. 710 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., publisher, 1952. Price $14.50.

Renal Function, Transactions of the Third Conference, October 18-19, 1951, New York, N. Y., edited by *Stanley E. Bradley,* Department of Medicine, College of Physicians and Surgeons, Columbia University. 210 pages; illustrated. Sponsored by the Josiah Macy Jr. Foundation, New York, N. Y. Price $3.50. Printed in the U. S. of America by Corlies, Macy & Co., Inc., New York, N. Y.

Principles, Problems, and Practices of Anesthesia for Thoracic Surgery, by *Henry K. Beecher,* M. D., *Henry Isaiah Dorr,* Professor of Research in Anesthesia, Harvard University; Director, Department of Anesthesia, Massachusetts General Hospital, Boston, Mass. American Lecture Series Publication No. 139, A Monograph in American Lectures in Anesthesia. 65 pages. Charles C Thomas, Publisher, Springfield, Ill., 1952. Price $2.50.

A Textbook of Pathology, by *E. T. Bell,* M. D.,Emeritus Professor of Pathology in the University of Minnesota, Minneapolis, Minn. Contributors: *B. J. Clawson,* M. D., Emeritus Professor of Pathology in the University of Minnesota, and *J. S. McCartney,* M. D., Professor of Pathology in the University of Minnesota. 7th edition. 1,008 pages; illustrated. Lea & Febiger, Philadelphia, Pa., publisher, 1952. Price $12.

Basic Principles of Cancer Practice, A Book on Diagnosis, Prognosis, and Treatment of Human Neoplasms for the General Practitioner and Medical Student, by *Anderson Nettlesbip,* M. D., F. C. A. P., Fellow, New York Academy of Medicine; Professor of Pathology, University of Arkansas School of Medicine; Pathologist-in-Chief, University Hospitals, Little Rock. 398 pages; illustrated. Williams & Wilkins Co., Baltimore, Md., publisher, 1952. Price $7.

Adrenal Cortex, Transactions of the Third Conference, November 15-16, 1951, New York, N. Y., edited by *Elaine P. Ralli,* Department of Medicine, College of Medicine, New York University, New York, N. Y. 204 pages; illustrated. Sponsored by Josiah Macy Jr. Foundation, New York, N. Y. Price $3.25. Printed in the U. S. of America by Progress Associated, Inc., Caldwell, N. J.

The Knee and Related Structures, Injuries, Deformities, Diseases, Disabilities, by *Philip Lewin,* M. D., F. A. C. S., F. I. C. S.; Professor and Chairman of Department of Bone and Joint Surgery, Northwestern University Medical School; Attending Orthopedic Surgeon, Cook County Hospital; Senior Attending Orthopedic Surgeon, Michael Reese Hospital; Professor of Orthopedic Surgery, Cook County Graduate School of Medicine, Chicago; Formerly Colonel, Medical Corps, A. U. S. 914 pages; illustrated. Lea & Febiger, Philadelphia, Pa., publisher, 1952. Price $16.

Useful Drugs, A Selected List of Essential Drugs With Brief Discussions of Their Actions, Uses, and Dosage. Issued Under the Direction and Supervision of the *Council on Pharmacy and Chemistry of the American Medical Association.* 15th edition. 262 pages. J. B. Lippincott Co., Philadelphia, Pa., publisher, 1952. Price $3.

Physical Diagnosis, by *Harry Walker,* M. D., F. A. C. P., Professor of Clinical Medicine, Medical College of Virginia, Richmond, Va. 461 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., publisher, 1952. Price $8.

Annual Reprint of the Reports of the Council on Pharmacy and Chemistry of the American Medical Association, With the Comments That Have Appeared in the Journal of the American Medical Association, 1951. 165 pages; illustrated. J. B. Lippincott Co., Philadelphia, Pa., publisher, 1951.

Planning and Designing Removable Partial Dentures

Part II [1]

Arthur H. Schmidt, *Colonel, U. S. A. F. (DC)*

THE basis for all successful removable partial dentures is embodied in the words: *plan, design,* and *construct.* The technician's responsibility begins and ends with fitting a denture to a master cast made from an impression taken by a dentist and articulating the denture according to an occlusal registration furnished by the dentist. This limited responsibility does not mean that the laboratory technician should have no concern for the interests of his clients. On the contrary, he should learn the biologic factors involved in restorative dentistry.

Many of us interested in the teaching of removable partial denture prosthesis have felt the need for a better understanding of the principles involved. Recognizing the impossibility of giving students a solution for each problem that may arise, we have been forced to stress basic principles, which, if applied with judgment based on clinical experience, should aid the student in solving most of the problems commonly encountered.

In the construction of removable partial denture, simplicity should be a byword. The simpler the appliance, the less need for adjustments and repair. Considering the importance of the removable partial denture to the patient and to the dentist, it is surprising how many appliances are constructed without adequate planning. Thorough planning of the finished appliance *before* work is started is the secret of success in partial denture prosthesis. The dentist or technician needs a blueprint from which to work just as surely as does an engineer.

Because the positions of all clasps on the denture are fixed relative to each other, they must all seat along the same path of insertion (fig. 1). As they are all designed with the model set at the same fixed angle to the spindle, a common path of insertion is automatically estab-

(1) Part I appeared in the Armed Forces Medical Journal, vol. 1, pp. 1465-1471, Dec. 1950.

lished; the change of tilt reverses the undercut areas of the abutment teeth, thereby creating an entirely different clasp indication on each one.

Reduced to its simplest terms, surveying a tooth is a mechanical method of obtaining its height of contour accurately. The mathematical principle involved is easily understood. If a vertical plane is brought into contact with a curved surface, it will touch at the greatest bulge on the convexity and nowhere else (fig. 2). Should the curved surface be rotated against the vertical plane, an imaginary line which represents the greatest circumference will result. On a tooth, this line is the height of contour and is the guideline from which the correct position of the clasp is determined.

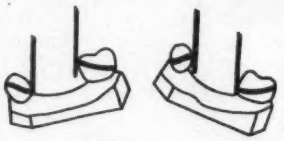

Figure 1.

Figure 2.

Figure 3.

The location of the all-important height of contour on any abutment is easily found with the surveyor. When that location is known, the undercut areas are evident. In the preliminary analysis the abutment tooth is brought into contact with the metal analyzing rod (fig. 3). The rod will contact the tooth at the greatest circumference and nowhere else.

Figure 4.

Figure 5.

Figure 6.

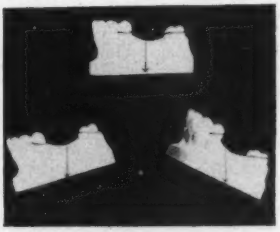

Figure 7.

If the analyzing rod is now replaced with the carbon marker and the tooth rotated around the marker, a line will be drawn on the tooth which represents the height of contour on that particular tooth (fig. 4). That is the guideline or the survey line.

All areas below the guideline, that is between the line and the gingiva of the tooth, are undercut areas (shown by the hatched section on the molar in figure 5).

The nonundercut areas of the tooth are those above the guideline, between it and the occlusal surface (fig. 6). The position of the clasp on the tooth is determined according to the location of these undercut and nonundercut areas. The exact location must, of necessity, be known before any planning of the denture can be started.

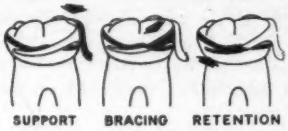

Figure 8.

Figure 9.

Figure 10.

With various tilts these lines change their position on the teeth so that if a certain clasp were indicated on a molar because of the particular position of the undercut, that same clasp could not be used successfully on the same tooth if the tilt were changed because this would cause a different type of undercut (fig. 7).

In order to understand the basic principles of clasp design, it is necessary to be familiar with the essential functions of a clasp. Each clasp of a partial denture must supply a definite amount of support, retention, and bracing action if the partial denture is to be successful (fig. 8).

The clasp shown in figure 9 provides support because of its occlusal rest at the rigid portion of the clasp above the guideline. It is the mechanical function of the rest to prevent movement of the partial denture toward the tissue. This function is enhanced by well-designed occlusal rests on all abutment teeth.

Bracing is supplied by the rigid body portion of the clasp over the nonundercut part of the tooth (fig. 10). The mechanical function of bracing is to prevent lateral shifting or movement of the removable partial denture and is supplied chiefly by the rigid portions of the clasp.

Retention is provided by the flexible arms or tips engaging an undercut below the guideline, which prevents the dislodgment of the removable partial denture (fig. 11). It is essential in planning any removable partial denture to consider the sum total of support, bracing, and retention provided by all the clasps on the appliance. The denture must be planned as a unit.

Each section of the clasp has a separate function, yet each function is interrelated. An occlusal rest will not provide retention; the flexible tip will not provide bracing; nor can the rigid section be used for retention (fig. 12).

The model A (fig. 13) is mounted with its occlusal plane at right angles to the vertical spindle. At this tilt, which we will call zero tilt, the relation of the vertical lines to the abutment teeth shows that

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adequate retention for the denture could not be obtained. The model B with a posterior tilt, that is, with the heel down, eliminates the undercut on the mesial side of both abutments and increases the undercut on the distal side. The model C with an anterior tilt shows that the undercut areas are shifted to the mesial side of the abutments. By tilting the model we have been able to vary the location and the amount of undercut on each of the abutments. If we can change the position of undercut areas, we can change the position of the clasp on the tooth.

Figure 11.

Figure 12.

Figure 13.

Figure 14.

For example, it may seem desirable to bring the labial arm of an anterior clasp close to the gingival for esthetic reasons, but, by so doing, an unsatisfactory clasping condition may be created on some other abutment tooth. In any partial denture, the most efficient clasping condition should be sought, but in practice there are many conditions which force us to compromise. Tilting the model is the procedure which enables us to effect this compromise while still making it possible to design the case as a unit.

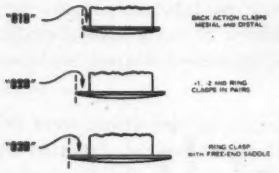

Figure 15.

Figure 16.

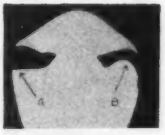

Figure 17.

Tilting not only changes the location of undercut areas, but alsc varies the degree of undercut of any tooth. It becomes necessary, therefore, to find an answer to the question, "How far below the guideline do you place the tip of a clasp?" There can be no universal answer because of the wide variation in the contour of each individual tooth and because the distance below the line is not the controlling factor in the problem. Figure 14 shows sections of two differently shaped teeth. Both are in the same plane at the same tilt and both have the same height of contour as indicated by the horizontal dotted lines. These lines represent the guide or survey lines. Because the profile of tooth A is quite different from that of tooth B, we can readily see that for the same distance below the guideline the undercut is more severe on A than on B. The horizontal distance X is the same on both teeth, but on A it is much closer to the guideline than on B. The same

amount of undercut is available at X on both teeth. Thus the horizontal rather than the vertical measurement of the distance below the guideline is the deciding factor in the placement of the clasp tip.

In practice, the small dimensions of the teeth make it difficult to determine by eye alone whether a particular undercut is sufficient for adequate retention or not. For that reason, the Ney undercut gages were developed. The gages are used, not only in determining the correct amount of undercut on any tooth, but also in making the final tilt adjustment on the model. With the general clasp design plan in mind, it

Figure 18.

Figure 19.

Figure 20.

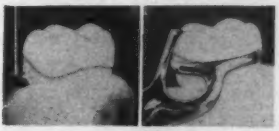

Figure 21.

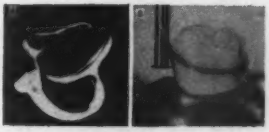

Figure 22.

is possible to tilt the model accurately to accommodate the clasp of choice for the particular case. Each gage provides an exact and specific amount of horizontal undercut as indicated by the distance of the rim of the gage head from the shank (fig. 15).

The No. 3 or wire clasp resembles the No. 1 clasp in function and design, except that it is made of wrought wire and hence supplies less bracing effect than the No. 1 cast clasp (fig. 16). In the No. 2 or divided-arm clasp, the clasp arms are joined to the saddle and are of ample length, thus reducing its bracing effect. In practice, especially in the designing of bilateral cases, the tooth often presents one type of surveyed line on one side and a different type on the other. In such instances, it may be desirable to use a combination clasp corresponding to the combination of survey lines. The 3 possible combination clasps are the No. 3-1; No. 2-1; and the No. 2-3 (fig. 16).

It is imperative to check carefully the occlusion before designing occlusal rests. If occlusal rests are constructed over unprepared marginal ridges (fig. 17B), breakage will occur because of the thinning out of the material where it crosses the marginal ridge. Figure 17A shows a reduction of the marginal ridge, thus providing a rest of uniform thickness and adequate strength. All ground enamel surfaces must be highly polished. All preparations on abutment teeth must be prepared before the final impression is taken, and all remaining teeth in the mouth must be given a thorough prophylaxis before the final impression

is secured. In the surveyor system of clasp design the principal cast clasps are the No. 1 clasp, the No. 2 clasp, and the No. 1-2 combination, the back-action clasp, and the ring clasp.

The No. 1, the No. 2, and the No. 1-2 combination clasps shown diagrammatically in figure 18 differ from the back-action and the ring clasps in that they provide double retention within their own structures. The double bracing is supplied by the two clasp-arm shoulders, and the double retention by the two clasp-arm tips. Because of this fact, these clasps are used successfully on unilateral cases which need not depend on clasps on the opposite side of the arch to augment bracing and retention. In such cases the model can be tilted laterally to create conditions providing double bracing and double retention. On bilateral cases where the abutments stand straight in the arch in relation to each other, so that bracing and retention are obtained both buccally and lingually on each individual tooth, the No. 1, the No. 2, or the No. 1-2 combination are the ideal clasps.

When the more frequent condition exists—that is, when the abutments lean lingually or buccally and show retention on one side only and bracing on the other—the back-action and ring clasps (fig. 19) are ideal. Back-action and ring clasps must not and cannot be used on unilateral cases because they brace the denture against lateral movement in one direction only. A clasp must be provided on the other side of the arch which will supply the necessary bracing in the opposite direction.

The No. 1 clasp comprises the 3 sections necessary for successful clasp function: the occlusal rest, the rigid shoulder, and the flexible tip. The survey line is low enough on the side next to the edentulous area so that the rigid body of the clasp can be placed above it without interfering with the bite. The line is high enough on the opposite side of the tooth to provide retentive areas for the flexible tips. This type of line is a characteristic indication for the No. 1 cast clasp and is called the No. 1 survey line (fig. 20). The amount of undercut which will give satisfactory retention with a No. 1 clasp is measured with the ".020" undercut gage. The finished clasp fits the tooth snugly along its entire length, and its rigid shoulders act somewhat like a 3/4 crown, preventing lateral movement of the denture. The rigid section is kept above the survey line, out of the undercut, which is the only way the clasp can be seated without either grinding out the inside or forcing the abutment out of its normal position in the arch.

The No. 2 clasp is indicated for abutment teeth where the severest undercut is adjacent to the edentulous area and this condition cannot be modified and improved by tilting the model. A typical No. 2 survey line is high on the tooth nearest the edentulous area and lower on the opposite side (fig. 21A). Under such circumstances the long flexible arms can be made to curl back into the undercut below the occlusal rest and so provide essential retension (fig. 21B). The correct amount

of retention for a denture using No. 2 clasps will be obtained when the ".020" gage is used.

The No. 1-2 combination clasp is just what the name implies. One half has a No. 1 clasp arm and the other a No. 2 (fig. 22A). Molar abutments may be badly tilted or rotated and present a No. 1 line on one side of the tooth and a No. 2 clasp indication on the other. The correct amount of undercut for the No. 1-2 combination is measured with the ".020" gage and this measurement is taken at both tips of the No. 1 and the No. 2 arms (fig. 22B).

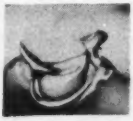

Figure 23.

Figure 24.

Figure 25.

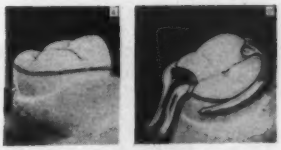

Figure 26.

The occlusal rest of the No. 1 arm supplies the support. There are two flexible tips, one on the No. 1 and one on the No. 2 clasp sections, each engaging an undercut area. Together they provide excellent retention (fig. 23). A frequent application for this clasp will be found on a molar tooth presenting the undercut conditions outlined and which will have a tooth replaced behind it.

The first of the single-bracing and retaining clasps is the back-action clasp (fig. 24). It is always attached to the denture at one end, usually the mesiolingual end. The connecting strut must be kept out of an undercut. This clasp has a rigid section close to the connecting strut which supplies the necessary bracing. That bracing is in one direction only and, therefore, the back-action clasp must be used in conjunction with a clasp on the other side of the arch which will brace the denture in the other direction. For this reason back-action clasps can only be used on bilateral cases. The ".010" gage will show the correct amount of undercut for back-action clasps. The measurement is taken at the distal and at the mesiobuccal tip position of the clasp.

On occasions, lower bicuspid abutments will have such a pronounced lingual tilt as to produce a severe lingual undercut and no buccal undercut. In such cases a conventional back-action clasp cannot be used because the rigid lingual body could not be kept out of the undercut unless it could be carried over on the occlusal surface. An abnormal amount of relief would have to be given the connecting strut to enable it to pass the undercut and allow the denture to seat. The solution to the problem lies in the use of a reverse back-action clasp (fig. 25). This clasp is attached to the denture at the buccal with a connecting arm to the buccal of the saddle, as indicated by the arrow. The rigid bracing section is on the buccal instead of on the lingual. The flexible portion engages both the distal and the lingual undercut for retention.

In most cases, molar abutments are tilted, lower molars usually leaning lingually and upper molars buccally. This creates a condition which places all the undercut areas on one side of the tooth with no undercut for retention on the other side (fig. 26A). The clasp to use in such a situation is the ring clasp (fig. 26B). It should be used on any molar abutment which will not have a tooth replaced behind it. On bilateral cases, all tooth-supported dentures which have two posterior clasps, one or both being ring clasps, the correct amount of undercut is measured with the ".020" gage. If the denture is tooth-supported on one side and a free-end on the other side, the clasp on the posterior abutment is a ring and the undercut is measured with the ".030" gage.

Figure 27.

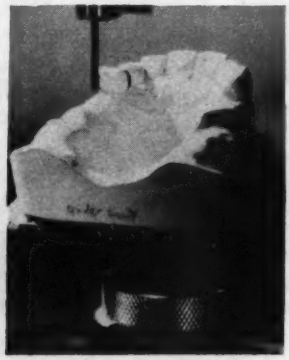

Figure 28.

CONSTRUCTING AN UPPER REMOVABLE PARTIAL DENTURE

A back-action clasp is indicated on the right first bicuspid and a back-action clasp on the left cuspid. An anterior and posterior bar are used for this double free and saddle case. With the mandrel in the tool holder of the surveyor, adjust the table and cast to a posterior tilt, checking with the mandrel to obtain an undercut on the distal of both abutment teeth, and at the retentive or extreme end of the clasp location (fig. 27). This may be termed the preliminary survey.

Without changing the tilt, the ".010" undercut gage is placed in the tool holder and the gage is placed in contact with the first bicuspid to see if the required undercut is obtained (fig. 28). It may be necessary to change the tilt of the cast in order to obtain adequate retention, or to reduce the amount of undercut on the bicuspid, and then recheck the relation on the cuspid. When the correct tilt is determined, and with the vertical shank of the undercut gage in contact with the tooth, and the gage head contacting the tooth in the distal undercut, a light pencil line is made at the gage head contact.

The undercut gage is removed and the carbon marker is placed in the tool holder. Note the shape of the carbon marker in figure 29. The

beveled end is used to outline the anterior end of the saddle next to the abutment tooth. With the carbon marker lightly contacting the tooth, the spindle is raised and lowered, creating the survey line on the tooth surface and the mark made by the sharp edge of the carbon on the ridge. The dotted line on the tooth, which designates the gingival outline of the finished clasp, was made with the undercut gage in position.

The top line on the tooth shown in figure 30 is the guide or survey line; the center line is the position for the gingival outline of the finished clasp; and the bottom line is the base undercut line. The back-action clasp is connected to the bar from its lingual arm and, because there is no truss arm at the distal of the tooth, base material will fill the space between the saddle edge and the tooth. Use a thin knife blade to cut a groove on the base line over the ridge. This groove will produce an embossed line on the inside of the finished denture, designating the end of the saddle. A cut from this line to the inside of the clasp, with a fissure bar, will remove the material so that the partial denture can be inserted following the path of insertion established when surveying the case. The space between the top and the bottom lines is the undercut area and, when placing the undercut wax on the tooth, the wax must not be allowed to extend beyond the gingival clasp line, or middle line. The thickness of this ledge of wax at the middle line is determined by a plane between the top line and the bottom line.

Figure 29.

Figure 30.

Figure 31.

The ledge or shelf of undercut wax, when reproduced to an investment cast, affords a distinct seat for placing the clasp wax form (fig. 31). This case is to be constructed with a posterior and an anterior bar. Thus the lingual surfaces of the anterior teeth must be surveyed to eliminate any undercuts that might interfere with the seating of the denture. The bar will also function as an indirect retainer so that the gingival crevice around the lingual of each tooth must be filled in with

undercut wax to protect the free margin of the gum from irritation as the bar crosses over onto the lingual surfaces of the teeth.

The cast is placed in warm water for 45 minutes, then placed in a duplicating ring and poured up in hydrocolloid. When the material has thoroughly cooled, the ring is separated and poured up with a good casting investment. The wax ledges previously prepared on the master model are reproduced on the investment cast and clearly indicate the position of each clasp (fig. 32). Before proceeding with the wax-up,

Figure 32.

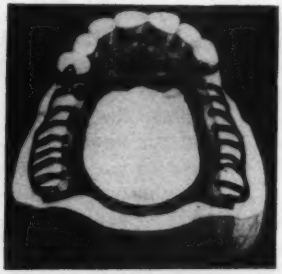

Figure 33.

the investment cast should be soaked in hot beeswax to produce a tacky surface to which wax will stick readily and to help eliminate roughness on the model side of the casting. The cast should first be dried at from 200° to 250° F. for 2 minutes and then immersed in hot beeswax at 300° F. for 1 minute.

Large back-action wax forms are used for both abutment teeth. The anterior bar is made of 2 sheets of casting wax, 30 gage. The posterior bar is the regular palatal wax bar form placed at the same outline as the posterior border of a full upper denture. Retention for the base material may be added in various ways. The wax pattern is given a glossy finish, sprues are attached, and the case is invested and cast (fig. 33).

The casting should be checked on the master model to determine the correct path of insertion and the correct fit of the casting before it is inserted in the mouth (fig. 34). After careful examination in the mouth as to insertion, fit, and occlusion on occlusal rests, the various records are obtained and the case is mounted on the articulator for completion.

CONSTRUCTING A LOWER REMOVABLE PARTIAL DENTURE

The illustrations shown here are those of the denture of a 54-year-old man in good physical health. He had never acquired his lower second or third molars. The right abutment tooth had a large gold occlusal restoration and from the roentgenogram the dense cortical bone and

the periodontal tissues appeared to be normal. The abutment tooth on the left side had a large disto-occlusal gold inlay restoring the lingual cusp. The tooth and surrounding structures were healthy.

The model (fig. 35) is attached to the tilting top of the survey table and the abutment teeth and involved tissue are "analyzed" by bringing them into contact with the analyzing rod. The model should be tilted experimentally at various angles and the resulting undercuts tested with the analyzing rod each time. The tilt that is ideal for clasping one of the abutments may make it impossible to clasp the other satisfactorily. Reverse back-action clasps are indicated for this case because the bicuspid abutments incline lingually, presenting very little undercut on the buccal of either tooth.

The tilt is decreased until a ".010" horizontal undercut is obtained with as much tooth covered on the distal as possible. A mark is made where the gage head contacts the tooth. The gage is removed, the carbon marker is put in the tool holder, and the spindle is raised and lowered—keeping the carbon against the tooth and marking the survey line with the side of the carbon and the base line with the sharp edge of the carbon marker. Figure 36 shows the right first bicuspid with the top or survey line, the center or gingival clasp line around the distal of the tooth, the base undercut line across the ridge distal to the abutment tooth, and the undercut area present on the buccal surface of the stone model.

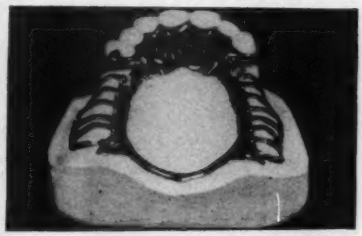

Figure 34.

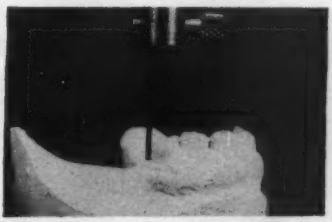

Figure 35.

Figure 37 shows a lingual view of the model with the 3 lines on the distal surface of the abutment teeth. A slight undercut is marked out on the mesiolingual surface of the left first bicuspid and cuspid and an undercut area is shown above the anterior floor of the mouth.

The outline of the saddles, bar, and clasps are drawn in accordance with the survey lines obtained (fig. 38). Undercut wax is applied to each abutment tooth to establish the clasp seat and to establish a seat for the connecting arm from the mesiobuccal clasp end to the saddle.

A lingual bar wax form is placed in correct position on the stone model and outlined with a pencil. The base outline indicates the plac-

ing of the undercut wax in the forming of a slight shelf for the correct positioning of the wax bar on the investment cast. The gingival crevice is filled around the lingual of all anterior teeth and any undesirable undercuts are filled in (fig. 39).

Figure 36.

Figure 37.

The master model is now duplicated in casting investment and the investment cast is treated with the beeswax bath (fig. 40). This is the technic for making a removable partial denture of metal and porcelain. Two thicknesses of 30 gage wax are placed over the saddle areas and each tube tooth is ground to fit the ridge and undercut waxing. After all the teeth are placed and checked for occlusion and articulation, lubricate the occlusal surface of the adjacent teeth and pour a plaster core over the top of all teeth involved, forming a matrix that will make it possible later on to position the tube teeth correctly on the investment cast.

Figure 38.

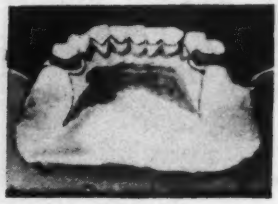

Figure 39.

The waxing of the investment cast. A large back-action wax form shown at the base of the cast was used for the bicuspid abutment (fig. 41). Adaptation was started at the mesiobuccal on the tooth and after bending it over into its seat, a shaped pencil eraser was used and the form gently forced against the shelf. The occlusal rest on the distal was built up and attached with a small amount of wax and a hot spatula. The connecting arm of the reverse back-action clasp was made of half of a large No. 1 wax form curved to the proper shape.

Preliminary to placing the tube tooth, one thickness of 30 gage wax was adapted to the cast and trimmed to the saddle outline. Because the tooth was ground with clearance to accommodate 2 thicknesses of 30 gage wax, space for the additional thickness which is required for boxing each tooth remained (fig. 42). The boxed tooth was reseated on the occlusal core and carried to place on the investment cast. This eliminated the necessity of mounting the investment cast on an articulator to obtain the correct relation. The boxing was sealed to the saddle. If more than one tooth is replaced, each tooth should be formed and waxed to the saddle, one tooth at a time. A second sheet of wax, to produce the desired thickness of saddle, is adapted around the neck

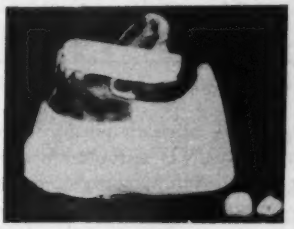

Figure 40.

Figure 41.

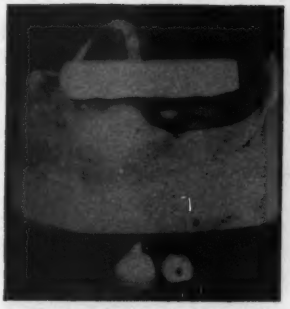

Figure 42.

Figure 43.

of the tooth and to the outline of the saddle. The wax bar form is adapted and two thicknesses of 30 gage wax are extended from the bar on the lingual surfaces of the anterior teeth.

In waxing a case for acrylic saddles, the clasps and bar are placed as in the preceding case, using the retention of the wax lingual bar form. For added retention of base material and to obtain a neat finish line on the buccal, take a wax palatal bar form and cut it as shown in figure 43, using the center section. Polish the wax pattern, provide a sprue, and invest for casting. A convenient and efficient method of

burnout is to increase the heat gradually over a period of 1 hour until the sprue hole is a dull red and continue heating at dull red for at least 30 minutes more. Care should be taken to avoid heating the investment above 1300° F. or a dull red because at higher temperatures the calcium sulfate in the investment breaks down and gives off a corrosive gas which is frequently the cause of pits and gas blowholes in the casting. Sulfides, which are very difficult to pickle off, are also deposited on the surface.

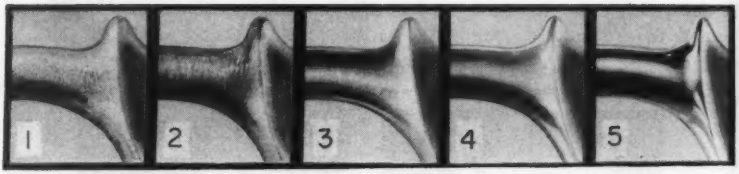

Figure 44.

Figure 44 shows, from left to right, the surface produced by successively grinding with: (1) heatless stone, (2) carborundum disk, (3) rubber wheel, (4) tripoli, and (5) rouge. In finishing, progressively finer grits should be used in each successive step so as to eliminate the deep scratches gradually and produce a smooth high polish. The importance of high polish cannot be overemphasized. Rough, poorly polished areas tend to hold the saliva and cause any solid matter present to be deposited on the surface of the metal in much the same manner that film forms on natural teeth.

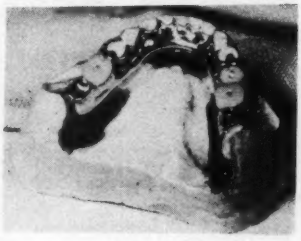

Figure 45.

Figure 46.

The function of a partial denture is to protect and preserve the remaining teeth as well as to restore the missing teeth. This necessitates designs and attachments which do not injure those remaining teeth and which brace them against unfavorable forces. The occlusion of partial dentures must be developed to reduce the unfavorable forces to a minimum. The case here illustrated (fig. 45) has been in use for over 4 years and has fulfilled the requirements of a good removable partial denture. Observe the lingual contour developed in the bar as it follows the contour of each anterior tooth.

The finished gold casting for use with acrylic saddles is shown in figure 46. Observe (1) the contour and shape of the lingual splint bar, (2) the close relationship of the top part of the bar to the lingual surfaces of the teeth, (3) the finish line on the lingual bar on the left side, and (4) its position to the distolingual surface of the left second bicuspid.

CONCLUSION

Good removable partial dentures are the results of:

1. A thorough, general examination of the mouth with roentgenograms.

2. A thorough prophylaxis and the treatment of and removal of all questionable teeth.

3. The repair of all carious lesions.

4. Obtaining a preliminary impression and study casts and articulating them.

5. Drawing a tentative design on study casts, preparing occlusal rests and teeth by grinding.

6. Obtaining an accurate impression after all teeth are prepared.

7. Remembering that the basis for all successful partial dentures is summed up in the words plan—design—construct.

The principles of surveying, the significance of the survey line, the relation of the clasp to the survey line, and the opportunity presented by tilting the model to control the location of undercuts are basic factors which will enable the prosthodontist to solve any removable partial denture problem.

BOOK REVIEW

The Love and Fear of Flying, by *Douglas D. Bond,* M. D., Professor of Psychiatry and Department Head, Medical School, Western Reserve University. Preface by General *James H. Doolittle.* 190 pages. International Universities Press, Inc., New York, N. Y., publisher, 1952. Price $3.25.

This interesting study of the emotional trauma suffered by combat flyers is based on the author's experience as director of psychiatry for the Eighth Air Force in its operations over Europe in World War II. From August 1942 through April 1945 a total of 1,230 officers and airmen were removed from flying duty solely because of emotional disturbances. In the same period more than 60,000 other aircrew members successfully completed their scheduled tour of combat duty. A comprehensive and intelligent analysis of the influence of man's strongest emotions of love and fear on these casualties makes this volume a

unique and authoritative contribution to the understanding of this complex problem.

By the generous use of case histories, an insight is obtained into the powerful influence of the pilot's emotions on his success or failure in all types of flying, particularly in combat. Selection for pilot training, the author believes, cannot be a static process wherein a man is originally, and presumably permanently, emotionally qualified for a flying career. It must be a continuing procedure, frequently revaluated in the light of response to the phobic trauma experienced. Preliminary psychiatric screening of applicants in the military service may be of little value as time is seldom available for an adequate examination. The generally accepted practice of eliminating all applicants who exhibited during childhood such common neurotic tendencies as temper tantrums, nail biting, enuresis, somnambulism, stuttering, and definite phobias is opposed. In this study an acceptable percentage of man taken into the service, who gave a history of such symptoms during their hospitalization, "broke" only after completing a successful combat tour or following exposure to unusual stress. In a survey of successful combat flyers, "43 of the 100 (studied) showed more than slight symptoms of anxiety" and, of these, 25 had a history of past neurotic traits.

The production of emotional casualties in flyers was directly attributable to one or more harrowing experiences in combat but it was not always so obvious why other aircrew members survived the same, or more severe psychic trauma, and became successful crew members. Nearly all of the latter had an intense love of flying that dated back to childhood, coupled with an aggressive drive to gratify this emotion. In 1 group of 22 successful fighter pilots, there were 10 such men who made enviable records. Together 5 of them shot down 70 percent of the total number of enemy planes credited to the 22 pilots. Paradoxically, the author warns, "one need only look at the records to see that the men most successful in combat are unlikely to be so in civilian life, and that the men highly decorated for heroics in war would not be considered deserving of medals in time of peace." When primitive drives are freed and stimulated to produce a "killer" in wartime, his readjustment to civil life is more difficult than for the emotional casualty. Yet the very nature of the mission of the military flyer makes it "necessary to find those who are particularly susceptible to the call of the air."

Although of special interest to psychiatrists, this book should be thoughtfully read and studied by all flight surgeons as well as by other physicians who are responsible for the mental health of flying personnel. It is well written, adequately documented, and contains an appendix in which statistical data of psychiatric practice in the Eighth Air Force is tabulated. The inclusion of an index would have been helpful, and some of the abbreviations common in military medical reports used here may not be readily understood by the average reader.

—Col. R. J. Benford, U. S. A. F. (MC)

Gait Training for the Above-the-Knee Amputee

Helen M. Mendler, *Captain, WMSC, U. S. A. (1)*
James A. Shafer, *Captain, MC, U. S. A. (1)*
Raoul C. Psaki, *Lieutenant Colonel, MC, U. S. A. (1)*

THE result of an intensive research program concerning the role of the orthopedist and limb-maker in affording maximum benefit to the above-the-knee amputee leaves little doubt that the training program is a vital phase in the process of efficient application and adjustment to a prosthesis *(2)*. Kessler *(3)* stated that stumps that are contracted, weak, or improperly shrunk lead to innumerable difficulties in limb adjustment which precludes the possibility of a good walking pattern. Contractures of the hip may be prevented by constant daily attention to proper posture in bed, absence of pillows under the stump, and exercises that aid in maintaining the full length of the stump and its adjacent joint. Shrinking of the stump requires systematic care in bandaging so that the proper shape of the stump can be achieved, thus facilitating the wearing of the prosthesis.

Exercise should be aimed at maintaining the strength and control of trunk, gluteal, abdominal, and thigh muscles. Particular attention should be devoted to muscle imbalances about the hip as this will lead to a faulty gait. Posture and balance exercises on the normal lower extremity should be given before providing a prosthesis. When the amputee has received a properly constructed and fitted prosthesis he is ready to begin walking training. Proper balance is necessary for normal walking which has been described as a process of losing and regaining balance. Walking without proper balance leads to faulty body mechanics and gait. This is axiomatic and consequently during the first days of gait training much effort should be directed toward securing proper standing balance.

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(1) Physical Medicine Service, Letterman Army Hospital, San Francisco, Calif.

(2) Abt, L. E., and Stern, A.: Orthopedist in above-the-knee amputations. U. S. Armed Forces M. J. 12: 1801-1809, Dec. 1951.

(3) Kessler, H. H.: Amputation lessons from war. Am. J. Surg. 74: 307-314, Sept. 1947.

Proper balance may be accomplished by having the patient stand between the parallel bars, with his feet 10 inches apart and his hands on the supports, and having him shift his weight slowly to the normal leg. The shoulders and trunk should be relaxed. This position should be held for a few seconds. He should then slowly shift the weight to the prosthesis and hold this position for a few seconds. At first, much of the weight will be taken by the hands, which are slightly forward. As this exercise is practiced, the patient will be able to maintain correct balance with the hands taking practically no weight. With further practice this can be done with the hands at the sides.

Next, have the patient shift his weight to the normal foot and then gradually move the prosthesis forward slightly until the foot is just off the floor, hold for a few seconds, and replace the foot in its original position. The patient should then shift his weight slowly to the prosthesis, flex the normal knee and slide the foot backward several inches until the toe is touching the floor opposite the artificial ankle. This position of balance should be maintained for several seconds. When this maneuver is learned thoroughly, have the patient slowly increase the flexion of the knee until the foot is off the floor. This should be practiced until balance on the prosthesis can be maintained easily for several seconds with the hands resting lightly on the bars.

The next step is most important because it is the patient's first attempt to balance entirely on the prosthesis. Repeat the last procedure, then have the amputee raise the hands slowly until they are free of the bars and maintain balance for 10 seconds. Encourage the patient to do this with his trunk erect without dropping his pelvis on the side of the prosthesis. This motion usually causes leaning to the side of the prosthesis in an improper attempt to maintain balance. When this procedure is done with ease have patient extend the normal knee slowly until the leg is forward with the foot off the floor. As the ability to accomplish this increases have him move the normal leg slowly backward and forward, flexing the knee to avoid striking the floor with the foot.

Next have the patient stand with his feet 8 inches apart, shift his weight to the normal leg, and swing the artificial limb forward until his foot clears the floor. This position should be held for an instant and then the original position should be resumed. The weight should then be shifted to the prosthesis and the normal extremity should be swung forward. This is an important procedure because it develops the ability to shift from one foot to the other. The time spent on balancing in the preliminary stages enables the amputee to progress rapidly through the stages of walking, ascending and descending steps, and turning. In walking, the normal leg should always be advanced first to establish the proper length of steps.

The fundamentals to efficient, inconspicuous walking are: (1) walking with the feet close together; (2) walking with the feet close to the ground; (3) taking the same length of step with each foot; and (4)

spending nearly the same length of time balanced on each leg. In regard to (2) and (3) it is important that the motion and timing of the prosthetic extremity is synchronized with that of the normal. To do this, the patient must understand the mechanics of both the normal and prosthetic legs. In the normal gait, the feet are carried as close to the ground as possible from the point at which the foot leaves the floor to the point at which it returns. In other words, the foot covers the shortest distance between these two points in the least amount of time, and with the least possible effort.

The normal knee is slightly flexed when the leg is in its forward walking position, whereas the prosthetic knee is completely extended in that position. Because of this variance in mechanics, the length of stride with the prosthesis tends to be slightly longer than the stride with the normal leg. This tendency must be minimized to avoid faulty gait patterns.

Walkers can be divided into beginners, intermediate, and advanced classes. Individual instruction should be given insofar as possible. We have found it best to use a combination of individual and group instruction.

In general, with the exception of those who have lost both legs, all amputees remain in the beginners' class until they are able to walk comfortably at a normal walking speed without crutches or canes. As soon as they can accomplish all the activities prescribed for a class, they progress to the next class. The objectives of the *beginning* phase of walking instruction are learning balance and a normal speed of walking. As was mentioned before, the emphasis is on balance. As an aid to attaining the normal walking speed it is best to request the amputee to walk with his heels about 5 inches apart. First let him get the feeling of swinging his prosthesis forward and shortly he will be able to synchronize the timing of his steps.

Before doing any of the following exercises, which are for unilateral amputees, have the patient roll his pelvis and come into good posture. Have the beginning patient place his prosthesis in the forward walking position and take a step, forward then backward, with the normal leg. He should then take a series of forward steps with both legs to get the feeling of the swing of the prosthesis.

Stairs are ascended with the hands on the rails, one step at a time. Have the patient place his normal foot up one step, shift his weight to this foot, and place the prosthetic foot beside the normal foot. To descend, have the patient place the prosthetic foot on the next lower step and then place his normal foot beside it. When he can do this easily have him place the heal of the prosthetic foot on the same step as the normal foot, shift his body weight to the prosthesis, place his normal foot on the next lower step and place the prosthesis beside the normal foot. The instructor should explain to the amputee that his prosthetic

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knee will flex automatically as he shifts his weight forward to bring his normal foot to a lower level.

The objectives of the *intermediate* phase of walking instruction are (1) to develop a uniform stride and rhythm and (2) to learn the more common walking procedures. For forward walking and corrective walking exercises with this group, have the patient walk with good form with his feet about 5 inches apart for at least 10 minutes at a time in each class period until the fundamentals of good walking are mastered. Emphasize the necessity of carrying the feet close to the ground and starting off with the good leg to establish the length of step. When this can be done well, have the patient walk on a straight line using his arms if necessary for balance. An above-the-knee amputee must be sure to obtain sufficient speed in walking to flex the knee so as to clear the foot from the floor and to check the forward swing of the prosthesis by quickly extending the hip in order to extend the knee.

The instructor should tell the patient that unless there is sufficient speed, the prosthetic foot will drag and the consequent buckling of the knee may cause him to fall. If he allows the knee to buckle too often, he may develop faulty walking habits when he tries to overcome his fear of falling by raising the pelvis too high on the side of the prosthesis or by abducting the prosthesis to maintain the knee in extension.

Finally, he must learn to swing the prosthesis forward by only slightly elevating the hip. Minimal hip elevation can be accomplished if he learns how to give a quick upward pull with his lower abdominal muscles on the prosthetic side at the same time that he uses his hip flexors to initiate a step. The upward pull (same as a quickly executed pelvic tilt) allows enough room for his toes to clear the floor. In order to accomplish this movement it is necessary to have a strong gluteus medius on the normal side.

The next exercises are included in both the intermediate and advanced programs. The objective of the *advanced* class is to perfect the walking technic.

Have the patient do standing 180° turns by placing his normal foot forward, shifting his body weight to the ball of the normal foot, and pivoting toward the prosthesis. This leaves the prosthetic foot in a forward position at the completion of the turn and the normal leg in position to take a forward step. One hundred and eighty-degree turns while walking are accomplished in the same manner. The 45° and 90° standing turns are done with the feet about 6 inches apart. Without lifting his foot from the floor, have the patient pivot to the left by turning on the heel of his left and the ball of his right foot (pivot to the right by turning on the heel of his right and the ball of his left foot). In accomplishing the 45° turn while walking, instead of turning on the heel, step with the left or right foot respectively. The 90° turns

are accomplished while walking by pivoting on the prosthetic foot regardless of the direction of the turn.

To ascend stairs, have the patient place his normal foot 2 steps up, bringing the prosthesis to the same step. To descend, have him place his hand on the rail, opposite the side of the prosthesis, place the heel of the prosthesis on the edge of the next lower step, and transfer his weight to the prosthesis. He then moves his normal foot past the prosthesis to the next succeeding lower step, flexing the prosthetic knee as his normal foot begins descent. It is important that he does not try to descend with any portion of the prosthesis other than the heel on the step.

In the advanced group, the patient should be able to descend stairs alternately as above and without the aid of the railing. When walking up or down an inclined plane, have him shorten his stride in order to maintain maximal walking balance. He reduces his stride in proportion to the angle of inclination. Above-the-knee amputees may go up and down sideways with the normal leg nearest the top of the incline, or walk diagonally with the normal leg on the uphill side, or some may follow the normal pattern.

To seat himself, have him approach the chair from the front and swing his normal leg across the prosthesis close to the chair with his normal foot about 4 inches in front of the corner of the chair nearest the prosthetic side. He should turn 180° toward the prosthesis, then with his weight on his normal foot, bring the prosthetic foot back to the same level. Leaning slightly forward, he should place both hands on his knees, and lower his body into the chair. To rise from the chair, have him place his normal foot near the chair with the prosthesis slightly forward and lean forward, at the same time lifting his body weight out of the chair with his normal leg and assisting the effort by placing his hands on his knees. He then shifts his weight to the prosthesis and steps out with his normal foot.

To sit on the floor, have the patient place his feet from 6 to 8 inches apart laterally, with the prosthetic foot from 6 to 8 inches forward and shift his weight to his normal leg. He then flexes both knees, stoops, and places the hand of his normal side on the floor behind him. He reaches behind and places his other hand on the floor and lowers his body to the floor. To rise from the floor, have him place the hand of his normal side on the floor, slightly behind him, flex the knee of his normal leg, swing the hand of the prosthetic side across his body, and place it on the floor, at same time rotating his body and bearing his weight on his normal leg and both hands. He should come to the standing position, then shift his weight to the prosthesis and step out with his normal foot.

If backward steps are necessary, be sure they are short. Have the patient slide his feet along the floor with his legs straight rather than lifting them. Side steps to the left and right should be practiced also.

To step up a curb, have him approach the curb and place the heel of the prosthetic foot on it without looking down, keeping his knee completely extended. With a strong push from his normal foot, he should step on the curb with his normal foot. As skill develops, it is possible to learn to step up on a curb with either foot. To step down a curb, he should place the prosthetic foot down first.

To develop rhythm and relaxation in walking, have the patient walk to music. Records must be carefully selected. We have also tried having the patient kick a medicine ball back and forth with his normal foot, requiring him to balance momentarily on the prosthesis.

The following exercises are helpful to determine the progress of the patient: have him walk at normal speed, then stop at the instructor's command and balance on the leg which is bearing the body weight at the time. Inability to perform this exercise is the result of improper placement of the feet during the walking stride and hence unequal distribution of body weight. Have the patient walk at normal speed, conforming to the fundamentals of good walking. Then scrape the toe of the prosthesis on command. A good way to teach him to carry the sole and heel of the foot as close to the floor as possible is to have him walk at normal walking speed, lightly scraping the toe of both the prosthetic foot and normal foot in turn on the surface of the floor, and immediately on scraping the toe, placing the heel on the floor.

Finally, the following faults should be checked: (1) stepping off with the prosthetic foot first, (2) a limp of any type, (3) abduction of the prosthesis, (4) lifting the prosthetic foot too high, (5) placing the feet too far apart while walking, (6) lateral pelvic motion, (7) a rigid walking posture, (8) awkward turns, and (9) poor technic on stairs, ramps, and curbs.

CONCLUSION

The general training of above-the-knee amputees incorporates treatment before he obtains his prosthesis. He receives daily hydrotherapy, bandaging instructions, and percussion massage. Specific exercises are taken to prevent contractures, insure full range of motion, and to increase the strength of the hip muscles. General exercises are performed to promote ideal posture and balance and to increase the strength of the upper extremity, trunk, and normal lower extremity. We like to discontinue hydrotherapy and massage after the prosthesis is obtained except in special instances. Individual treatment is emphasized with special changes in the program as indicated for such complications as fractures, loss of joint motion, soft tissue defects, and amputations of other extremities.

All phases of the training program are co-ordinated in the weekly amputee clinic. The progress, complaints, and changes for each patient are checked. The physiatrist, orthopedist, physical therapist in charge of amputee training, the physical reconditioning representative,

and the prosthetist are all present at this time of reviewing each amputee. The informality of the clinic encourages suggestions and complaints by all concerned. The advantages of this clinic are that (1) changes in the prosthesis can be checked immediately by the prosthetist, (2) the stump can be examined by the orthopedist, and (3) the progress and faults in the training program can be elucidated by the therapists and corrected with the least delay. The physiatrist is the co-ordinator of the clinic and the amputee training program.

SUMMARY

The training program for above-the-knee amputees includes stump care and balance and posture exercises. Specific exercises are prescribed to prevent contractures and limitation of motion and to increase the strength and function of the remaining normal parts. Proper balance is stressed in the gait-training program, which includes progressive procedures to achieve the mobilization required in full daily living. Co-ordination of the entire training program is controlled in weekly amputee clinics held in the Physical Medicine Service.

BOOKS RECEIVED

Psychiatry and Medical Education, Report of the 1951 Conference on Psychiatric Education held at Cornell University, Ithaca, N. Y., June 21-27, 1951. Organized and conducted by the *American Psychiatric Association* and the *Association of American Medical Colleges.* Editorial Board: *John C. Whitehorn,* M. D. (Chairman); *Carlyle Jacobsen,* Ph. D.; *Maurice Levine,* M. D.; and *Vernon W. Lippard,* M. D. Editorial Assistants: *Stella Bloch Hanau* and *Robert L. Robinson.* 164 pages. American Psychiatric Association, Washington, D. C., publisher, 1952.

The 1951 Year Book of Physical Medicine and Rehabilitation (December 1950-January 1952), edited by *Frank H./Krusen,* M. D., Professor of Physical Medicine, Mayo Foundation; Head of the Section on Physical Medicine and Rehabilitation, Mayo Clinic. Associate Editors: *Earl C. Elkins,* M. D., Assistant Professor of Physical Medicine, Mayo Foundation; Consultant in Physical Medicine and Rehabilitation, Mayo Clinic, and *George G. Deaver,* M. D., Professor of Clinical Rehabilitation and Physical Medicine, New York University College of Medicine; Director of the Department of Physical Medicine and Rehabilitation, Bellevue Hospital. 382 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., 1952. Price $5.50.

Tubercle Bacillus and Laboratory Methods in Tuberculosis, by *M. A. Soltys,* Ph. D., D. M. Vet., Lecturer in Bacteriology (School of Veterinary Science) University of Liverpool, in collaboration with *C. A. St. Hill,* M. B., Ch. B., Consultant Pathologist to the Royal Southern Hospital and Lecturer in Clinical Pathology, University of Liverpool, and *I. Ansell,* M. D., M. R. C. P., Consultant Physician to the Liverpool Chest Hospital. 212 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publisher, 1952. Price $4.50.

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Textbook of Medicine, by various authors. Edited by *Sir John Conybeare,* K. B. E., M. C., D. M. (Oxon.), F. R. C. P., Physician to Guy's Hospital, London, and *W. N. Mann,* M. D. (Lond.), F. R. C. P., Assistant Physician to Guy's Hospital, London. 10th edition. 912 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publisher, 1952. Price $8.

Physical Medicine in General Practice, with Twenty-two Contributors. Edited by *William Bierman,* M. D., and *Sidney Licht,* M. D. 3d edition. 798 pages; illustrated. Paul B. Hoeber, Inc., New York, N. Y., publisher, 1952. Price $12.50.

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Symposium on Radiobiology, The Basic Aspects of Radiation Effects on Living Systems, Oberlin College, June 14-18, 1950. Edited by *James J. Nickson.* Editorial Committee: *P. Morrison, E. S. Guzman Barron, H. M. Patt, M. Burton,* and *G. Failla.* Sponsored by The National Research Council of the National Academy of Sciences. 465 pages; illustrated. John Wiley & Sons, Inc., New York, N. Y., publisher, 1952.

Air Transportation of Acute Poliomyelitic Patients

Henry C. Hunley, Jr., *Commander, MC, U. S. N. (1)*

RECENT studies by civilian investigators have indicated that transportation over long distances may be harmful to a patient in the acute stage of poliomyelitis *(2)*. The Military Air Transport Service (MATS) has primary responsibility for the movement of military patients. In fulfilling this responsibility, thousands of patients are moved by air over long distances each year. In the course of these movements, MATS is frequently required to transport patients suffering from poliomyelitis. Several studies have previously been made of the effects of air transportation on various conditions. One study *(3)* showed that relatively more poliomyelitic patients developed in-flight symptoms than the general group studied, though it did not indicate the ultimate effects on poliomyelitic patients. The study by Brahdy and Katz *(2)* dealt with patients moved relatively short distances (average 85 miles) by unspecified means of transportation. That study presented no evidence to indicate that the more seriously ill patients were selected for transportation. Patients flown by MATS are required to be classified by a flight surgeon or other medical officer in advance of transportation as to their suitability for air transportation *(4)*. In consideration of these facts it appeared desirable to obtain further data on the effects of air transportation on poliomyelitic patients.

The MATS reports of patients evacuated by air in 1950 listed 72 patients with a diagnosis of poliomyelitis. The case histories of these patients were requested for study. No data were obtained on 14; the diagnosis of poliomyelitis in 7 others was not confirmed. Replies from various hospitals revealed that 10 of these poliomyelitic patients were

(1) Headquarters, Military Air Transport Service, Andrews Air Force Base, Washington, D. C.

(2) Brahdy, M. B., and Katz, S. H.: Effect of transportation on severity of acute poliomyelitis. J. A. M. A. 146: 772-774, June 30, 1951.

(3) Strickland, B. A., Jr., and Rafferty, J. A.: Effects of air transportation on clinical conditions; analysis of 16,000 cases reported in 1949. J. A. M. A. 145: 129-133, Jan. 20, 1951.

(4) Air Force Regulation No. 160-52, 28 March 1950; Army Regulation No. 40-535; Navy CNO Letter, Serial No. 20P56.

not in the acute stage when transported by MATS, though the responding organizations did not furnish clinical records or other detailed data. The reply from 1 hospital related details indicating that the poliomyelitic patient was past the acute stage when transported, though he arrived in a portable respirator. Clinical records or summaries were obtained on 40 patients with poliomyelitis.

Of the 40 records received, the age of the patient was stated in 29 cases. The median age of these patients was 18 years (range 1 to 36). Table 1 shows the age distribution of the transported poliomyelitic patients.

TABLE 1. *Age distribution of transported patients*

Age (years)	*Number of patients*
1-5	4
6-10	2
11-15	1
16-20	3
21-25	4
26-30	7
Over 30	8
Not stated	11
Total	40

There were 35 male and 5 female patients in the group. White patients numbered 23, while the race of the rest was not stated. A diagnosis of bulbar poliomyelitis was made in 5 patients, nonbulbar poliomyelitis in 28, and the differentiation was not made in 7. A respirator was used in treating 7 patients, not used in 27, and in 6 no data in this respect were available.

There were no fatalities during flight in this series. Three, all of them treated in a respirator, died later. In 1 of the patients who died the onset was on 5 November 1950. He was moved by air on 8 November, at which time he was acutely ill with bulbar poliomyelitis. He died on 12 November, the eighth day of his illness and the fifth day after his transfer by air. In another patient who died the onset was on 26 June 1950. He was admitted to the hospital on 27 June, transferred by air on 28 June in the acute stage of bulbar poliomyelitis complicated by atelectasis in the lower lobe of both lungs. He died on 1 July, the seventh day of his illness and the fifth day after his aerial journey. No information was obtained on the stage of illness when transported or the presence of bulbar involvement of the third patient who died. He was probably not in the acute stage when transported. His illness began on 24 October 1950 and he was transported in a respirator on 18 November. He died of infarction of the spleen on 19 May 1951 while

still a hospital patient. During his hospitalization after transportation by air he had been found to have a slight atelectasis in the right lung which was relieved by bronchoscopic aspiration.

Table 2 shows the status of the 40 patients on whom records were obtained, with respect to the stage of illness when transported. The fatality rate for the series was 7.5 percent compared with a rate of 6.4 percent in the United States for 1949, the most recent year for which Public Health Service mortality data are available (5). This difference is not significant, but of the 4 patients with acute bulbar involvement transported, there were 2 deaths, giving a case fatality rate of 50 percent for this type of patient. This is comparable with the findings of Brahdy and Katz (2), whose study showed that the case fatality rate among transported patients with bulbar and encephalitic involvement was 46 percent. Both these findings are significantly higher than the case fatality rate of 39 percent recorded among bulbar cases in the State of California during the period January 1948 to March 1949 (5). No figures are available for the whole United States on case fatality rates for poliomyelitic patients with bulbar involvement.

TABLE 2. *Stage of illness of 40 poliomyelitic patients*

Stage of illness	Number of patients	Ultimate death	Fatality rate per 100 patients
In acute stage	13	2	15.39
Not in acute stage	15	0	0.00
Not stated	12	1	8.33
Total	40	3	7.50

DISCUSSION

Although this is a small series, the correlation between a higher case fatality rate for poliomyelitic patients with bulbar involvement and transportation may be significant. Transportation by air, as observed in MATS, involves preflight movement from hospital to airport, and from airport to hospital after flight. In the course of an aerial journey there may be one or several landings, and there may be a "remain overnight" (RON) stop. The RON stop entails unloading, transportation to a medical facility, transportation back to the plane, and reloading. It has not been shown that the air-borne portion of the aerial journey adversely influences the outcome of the poliomyelitic patient with bulbar involvement. Considering all factors, however, the advisability of transporting such patients in the acute stage is questionable.

(5) Personal communication, dated 15 February 1952, from Assistant Director, Economic Analysis Department, The National Foundation for Infantile Paralysis, Inc., New York, N. Y.

In addition to the inadvisability, the need for transporting a patient while in the acute stage of poliomyelitis is questionable. The clinical management of poliomyelitis resolves itself into supportive and protective measures during the acute stages and special physical therapy and orthopedic care throughout convalescence. The institution of this special convalescent therapy is advisedly withheld until the patient is out of isolation (6), which should be for 1 week, or for the duration of fever if longer. If, during the acute stage, special lifesaving means are needed but not available locally, they could as easily be transported to the patient as vice versa.

Under the United States Foreign Quarantine Regulations, an aircraft with a case of poliomyelitis aboard arriving in the United States from abroad is subject to quarantine inspection (7). A person in the communicable period of poliomyelitis is prohibited from interstate travel in certain cases, under the Interstate Quarantine Regulations (7).

Although application of quarantine procedures to military air transportation is usually effected by the Armed Forces, the principles underlying the measures applied by the U. S. Public Health Service to nonmilitary traffic apply equally to military transportation. A patient in the acute stage of poliomyelitis is a potential hazard to other patients and passengers transported aboard the same aircraft. The hazard is reduced by the presence of medical attendants in flight and the use of isolation technics, but this residual hazard should not be imposed on noninfected fellow patients or passengers. In practice, passengers are not acceptable aboard air evacuation flights in the presence of patients in the transmissible stage of a communicable disease, except tuberculosis. Thus the presence of 1 patient with acute poliomyelitis aboard can jeopardize other patients and deprive priority passengers of needed and otherwise available air transport space without benefit, and indeed with possible harm, to the patient.

SUMMARY

Transportation over long distances has been shown to be possibly harmful to a patient in the acute stage of poliomyelitis. Study of a series of poliomyelitic patients transported by MATS in 1950 supports this finding. The need for transportation of a patient in the acute stage of poliomyelitis is questionable from the medical standpoint. Transportation of patients with poliomyelitis is covered by U. S. Interstate and Foreign Quarantine Regulations. A patient in the acute stage of poliomyelitis should not be considered suitable for air transportation unless needed lifesaving measures are not available locally and cannot be transported to the patient.

(6) Mead, S.: Prescription of physical therapy in poliomyelitis. J. Missouri M. A. 49: 215-218, Mar. 1952.

(7) Dunnahoo, G. L.: Legal aspects of air transportability of the sick. J. Aviation Med. 23: Feb. 3, 1952.

The Identification and Handling of the Dead[1]

Richard B. Phillips, *Captain, MC, U. S. N.*

Dale L. McKee, *Captain, DC, U. S. N.*

ONE of the more important duties of the flight surgeon is to identify the remains of the victims of aircraft accidents. In the majority of instances this is not difficult, being a matter of routine examination which can be carried out with dispatch and with certainty as to the identity of the victim. Every now and then, however, we are called on to examine the remains of military personnel who have been killed in a crash when the circumstances are such that identification is accomplished only with difficulty.

The establishment of death is of the gravest importance and every possible circumstance which can be elicited in those cases where identity of the body is in doubt must be investigated with the greatest care. Our primary duty is to the family of the deceased, then to the Navy and life insurance companies. Life insurance benefits cannot be paid to the beneficiaries of the deceased until acceptable evidence of identification and death have been recorded. There are a number of situations in which it is necessary to certify death on circumstantial evidence alone. Examples of these are cases in which a plane is seen to dive into the sea, or when a plane is lost on an overseas flight, in mountains, or in the arctic, and cannot be found. It is, however, the policy of the Department of the Navy to secure positive identification in every instance of death if this is humanly possible. Many thousands of dollars are spent annually for this purpose. For example, if a plane is lost in a bay or harbor where there is any possible chance of finding it and the victims of the crash, deep-sea divers may be flown in from great distances in order to carry out a search.

The next of kin are notified of a death by the commanding officer of the activity to which the deceased was attached. When identification has been positively established that fact is so stated. When identifica-

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(1) Naval Air Reserve Training Command, U. S. Naval Air Station, Glenview, Ill.

tion of the remains has not been positively established the phrase "and is presumed dead" is used, following a brief description of the time and place of the crash. At a later date, following the report of a Board of Investigation of Aircraft Accidents, a final report is made to the next of kin by the Secretary of the Navy.

All flight surgeons must be familiar with Aircraft Circular Letter 63 for 1950 (ACL 63-50) which has to do with the reporting of aircraft accidents. The 3 principal forms which concern the flight surgeon are Aircraft Accident Report (Form 339), Medical Officer's Report of Aircraft Accident (Form 339B, Rev. 8-51), and U. S. Navy Certificate of Death (Form N). It is also imperative that the medical officer be familiar with chapter 17 of the Manual of the Medical Department which has to do with the examination and handling of the dead.

An aircraft accident in the Navy is reported by the commanding officer to the Chief of Naval Operations by dispatch within 48 hours of its occurrence. The data so reported is arranged as directed in ACL 63-50. Form 339B is mailed to the Aviation Safety Activity, Naval Air Station, Norfolk, Va., within 96 hours of the accident. This activity has been recently established, formerly having been operated from the Pentagon. The 7 major parts of the report must be carefully filled out according to instructions printed on the Form. Within 15 days, the completed Form 339 is mailed to the Chief of Naval Operations and a copy mailed to the Aviation Safety Activity.

An autopsy will be performed whenever there is any doubt as to the cause of death. Rarely the possibility of a coronary occlusion or of carbon monoxide poisoning may have to be considered. It is conceivable that a decision as to whether a certain person drowned, or was killed by a fracture of the skull, might be important. The medical officer is always interested in the part played in crashes by various safety devices, such as belts, harnesses, helmets, oxygen equipment, seats, gear handles, et cetera, and frequently the condition of the body may give exceedingly important information as to function or nonfunction of this equipment.

In this connection, it is imperative that the flight surgeon examine the body of the victim of a crash personally and not delegate this work. Cases have arisen, even when the cause of death appeared to be obvious, when much trouble and inconvenience has followed the failure of the medical officer to perform the examination himself. Even when someone else is authorized to perform an autopsy, the medical officer should be present if at all possible.

The naval flight surgeon is a member of the Aviation Safety Council at naval air stations. He is also, by authority of ACL 63-50, a member of the Board of Investigation of Aircraft Accidents under the following conditions: (1) any accident in which there are injuries, whether treated or not, (2) deaths, (3) bailouts, (4) ejections, (5) ditchings, including crash landings in water, and (6) when circumstances are such

as to require comments and recommendations regarding unusual or improper performance of aviation personnel safety equipment, such as pressure suits, exposure suits, harnesses, oxygen equipment, or any other factor concerning human engineering as related to the cockpit or plane.

When the cadaver has not been carbonized or has not been in water very long the identification is usually a relatively simple matter. The Health Record of the deceased will give his height, weight, color of eyes, color of hair, et cetera. When fire or water has made the skin and general body configuration difficult to examine, the teeth, which fortunately are almost always available, may establish identity. A reasonably good fingerprint can be obtained even when the appearance of the skin would indicate that an attempt to do so would be useless. Often an injection of plain water or of mineral oil will bring out enough rugas to permit identification. It may be useful to obtain an enlarged photograph of the fingerprints.

In bad crashes, such as are attended by fire or explosion, a careful search for keys, coins, finger rings, wallets, identification tags, pocketknives, teeth, hair, or bits of clothing should be made. Unfortunately we have found that identification tags are not always worn. In 1 mid-air crash involving 2 aircraft we found only 7 such tags on the bodies of 19 victims.

We have had occasion to examine the bodies of several victims of water crashes. They had been mutilated by crustaceans to such an extent that even teeth were not available. In these cases the number on the parachute harness has been accepted as proof of identity, although it is purely circumstantial.

It is most important to establish, if possible, the exact time of death. This can sometimes be arrived at (when a crash occurs at an out-of-the-way place) by checking the gasoline quantity remaining in the tanks, when the tanks are not damaged, and computing the approximate time of the crash with reference to the time of take-off. The position of the tank selector valves should be noted. Medically we can often determine the approximate hour of death by studying the body for the stage of rigor mortis. The stiffness of the musculature which occurs after death does not begin for 2 or 3 hours. It involves the head and neck first, then proceeds to the torso and abdomen, and finally to the legs. It leaves the cadaver in the same sequence in which it appeared. Accordingly, if rigor mortis is found in the torso and arms, but not in the legs, death probably occurred less than 12 hours before. If the legs are stiff, but not the torso and arms, then death probably occurred 2 or 3 days before. Shortly after death the eyeball is glistening, but within 3 or 4 hours it becomes rather filmy and, later, opaque.

Instances have occurred in which the victim of a crash was killed on or about the expiration date of the last paid life insurance premium. The opinion of the medical officer as to whether a person died before

or after midnight may therefore determine payment of his insurance to his beneficiary. The evidence on which an estimate of the time of death is based must always be recorded.

When a crash occurs on a military reservation or on government land, the medical officer may take possession of the body immediately and remove it to the home station or to an undertaker, as he sees fit. When a naval hospital is within a reasonable distance, it is imperative to send the body to that institution, as all naval hospitals have a contract undertaker who is familiar with the necessary paper work and routine problems associated with deaths of naval personnel. When a crash occurs on civilian land, it is essential to get written permission from the county coroner or his deputy, or from the medical examiner, before removing the body. The coroner may be from any walk of life, for example, a carpenter, mayor of a small town, a farmer, or as is frequently the case, the local undertaker.

IDENTIFICATION THROUGH USE OF THE DENTAL CHART (NAVMED-H-4)

The importance of an accurately charted Dental Record (Navmed-H-4) as a means of identifying the dead has long been recognized. This is especially true in the case of personnel attached to aviation as mutilation or burning following a crash is frequently extreme, thus making positive identification difficult. The teeth, particularly the enamel-covered crown portion, are resistant to forces that ordinarily destroy soft tissues and even osseous structures. Fire, unless of extreme heat, immersion in water, or exposure to air for long periods of time, do not appreciably affect enamel. Fish, crustaceans, and animals do not include this material in their diet. Metallic fillings, prosthetic appliances, irregularities in placing, or spacing of the teeth in the dental arch, together with missing or unerupted teeth, are evidence not easily destroyed.

The responsibility for accurate charting of the teeth rests with the dental officer. Ordinarily, dental technicians are not sufficiently trained or observant to be trusted with this. Some of the irregularities and abnormalities that should unfailingly be included on the Dental Record are: (1) erosion, (2) abrasion, (3) mottled enamel, (4) hypoplasia, (5) rotation, (6) irregularity of alinement, (7) malocclusion (specify type), (8) retained deciduous teeth, (9) supernumerary teeth, (10) denticles, (11) Hutchinson's teeth, (12) abnormal interdental spaces, (13) mucosal pigmentation, (14) leukoplakia, (15) diastema, (16) hypertrophied frenum labiorum, (17) torus mandibularis and/or torus palatinus, and (18) embedded foreign bodies. If any of these cannot be recorded by marks on the chart, a note must be made of their presence in that portion of the chart set aside for remarks. In addition to the above all other unusual conditions should be noted on the chart of the Navmed-H-4.

NAVMED H-4
(1943)

DENTAL RECORD
(To be filled in by the dental officer)

DO NOT REMOVE FROM HEALTH RECORD

(Surname)

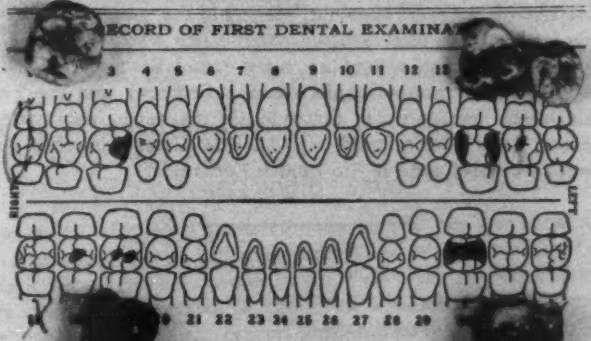
(Christian name(s))

Born: Place California Date 11-15-21

INSTRUCTIONS

See Chapter 14, Section VI, Paragraphs 2311-2319, inclusive, Manual of the Medical Department, U. S. Navy.

RECORD OF FIRST DENTAL EXAMINATION



REMARKS: 1-50: H-4 terminated [illegible] of [illegible]. H-4 served as means of identification. Following corresponding teeth recovered:

#3 with MO restoration
#19 with two occlusal restorations
#15 with occlusal restoration
#16 with no restoration
#18 with occlusal restoration

(Date and signature of examining dental officer)

Figure 1.

Occasionally, a so-called perfect dentition will be encountered. Note should be made that no fillings, missing teeth, et cetera, were discovered. A thorough search will, however, always reveal some condition, such as worn facets on the cuspids or posterior teeth, that can be recorded. The facets on the upper and lower teeth will fit because of enamel wear during mastication. Translucent enamel at the incisal edge of the anterior teeth is often present in this type of mouth. Mention should be made if the arches and teeth are unusually large or small. Gum tissue recession or hypertrophy are other conditions to search for in these mouths.

Flying personnel should be careful to ascertain that any dental treatment performed subsequent to the original examination is carefully and completely recorded on the Navmed-H-4. If work is performed by a civilian dentist, the Navmed-H-4 should be taken to a Navy dental officer with the request that an entry showing the treatment be made in the record.

The following case illustrates positive identification by examination of the teeth. A pilot crashed into a large pine tree which threw his plane out of control. When the plane hit the ground, there was an explosion and a large fire resulted. What little was left of the pilot's body was unrecognizable, and no teeth could be found. A bulldozer was brought up the mountainside along a firebreak and the engine of the plane which was partially embedded in the earth, was turned over. Underneath, 5 teeth were found (fig. 1). The fillings matched perfectly with the Navmed-H-4 page in his Health Record.

Treatment of Malaria With Cortisone

Otto A. Wurl, *Lieutenant Colonel, MC, U. S. A. (1)*
James O. Gillespie, *Brigadier General, MC, U. S. A. (2)*
William R. Beisel, *Captain, MC, U. S. A. (1)*

THE modification of the clinical expression of certain bacterial infections by cortisone and ACTH has recently been reported (3-5). Patients with pneumococcic pneumonia and typhoid fever have shown striking amelioration of clinical symptoms during treatment with these agents but the basic infectious process appears not to have been affected. To determine whether cortisone would modify the clinical expression of a protozoal infection prompted the observation of the action of this agent in 6 patients with malaria at this hospital.

METHOD OF STUDY

Six soldiers with benign tertian malaria who had acquired their infection in Korea and who had experienced one or more clinical relapses after their return to the United States were selected for study. After a short observation period to establish a control fever curve, each patient was given 100 mg. of cortisone intramuscularly every 8 hours for periods of from 3 to 6 days. Daily blood smears for parasites and daily circulating eosinophil counts were made during both the control and cortisone periods. At the conclusion of the study, each patient was given the standard antimalarial therapy prior to discharge from the hospital.

(1) Letterman Army Hospital, San Francisco, Calif.
(2) At Letterman Army Hospital at time of writing; now in the Office of the Chairman of the Armed Forces Medical Policy Council, Office of the Secretary of Defense.

(3) Kass, E. H.; Ingbar, S. H.; and Finland, M.: Effects of adrenocorticotropic hormone in pneumonia: clinical, bacteriological, and serological studies. Ann. Int. Med. 33: 1081-1098, Nov. 1950.
(4) Smadel, J. E.; Ley, H. L., Jr.; and Diercks, F. H.: Treatment of typhoid fever; combined therapy with cortisone and chloramphenicol. Ann. Int. Med. 34: 1-9, Jan. 1951.
(5) Woodward, T. E.; Hall, H. E.; Dias-Rivera, R.; Hightower, J. A.; Martinez, E.; and Parker, R. T.: Treatment of typhoid fever; control of clinical manifestations with cortisone. Ann. Int. Med. 34: 10-19, Jan. 1951.

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CASE REPORTS

Case 1. A 20-year-old man was admitted to this hospital on 30 June 1951 with chills, fever, headache, and generalized myalgia. He gave a history of an initial malarial attack in Korea in August 1950 with a recurrence in April 1951. Both attacks were treated with chloroquine. The attack which prompted admission to this hospital occurred shortly after his return to the United States and discontinuance of suppressive treatment. A blood smear was positive for *Plasmodium vivax,* and after 13 days' observation to record the fever curve (fig. 1) 100 mg. of cortisone was given every 8 hours for 6 days (total dosage 1.8 grams) with lessening of the headache and myalgia, but with no effect on the chills and fever. Daily examination of the blood was positive for parasites throughout the control and cortisone periods. After 6 days, treatment with cortisone was discontinued and with chloroquine was begun. This was followed by prompt disappearance of all symptoms and parasitemia. Circulating eosinophils were not recorded during the control period. They were absent during administration of cortisone.

Case 2. A 26-year-old man was admitted to this hospital on 24 June 1951 with a history of chills and fever every other day for 4 days. He had been wounded in the right forearm in Korea and had been under treatment for this condition at this hospital when he developed the above symptoms. He had had similar episodes of chills and fever while serving in Korea, but a positive diagnosis of malaria had not previously been established. Examination revealed a temperature of 104.4° F., a pulse of 106, and a soft, tender spleen, palpable 2 cm. below the left costal margin. A blood smear was positive for *P. vivax,* and after 5 days' observation (fig. 2), 100 mg. of cortisone was given every 8 hours for 4 days (total dosage 1.2 grams) with no effect on the clinical symptoms. Daily blood smears were positive for malarial parasites during the control and cortisone periods. Chloroquine was then administered for 3 days with remission of clinical symptoms and disappearance of parasitemia. Circulating eosinophils were markedly reduced during the control period and completely disappeared during cortisone administration.

Case 3. A 22-year-old man was admitted to this hospital on 5 August 1951 complaining of chills, fever, and headache. He had served in Korea until 20 July, and on returning to the United States, became ill aboard ship on 30 July. There was no history of malaria or chills and fever while in Korea. A blood smear was positive for *P. vivax,* and after 4 days' observation (fig. 3), 100 mg. of cortisone was given every 8 hours for 3 days (total dosage 900 mg.) with no effect on the clinical symptoms. Daily blood smears were positive for parasites during the control and cortisone periods. Chloroquine was then administered for 3 days with remission of clinical symptoms and disappearance of parasitemia. Circulating eosinophils were markedly reduced during both the control and cortisone periods.

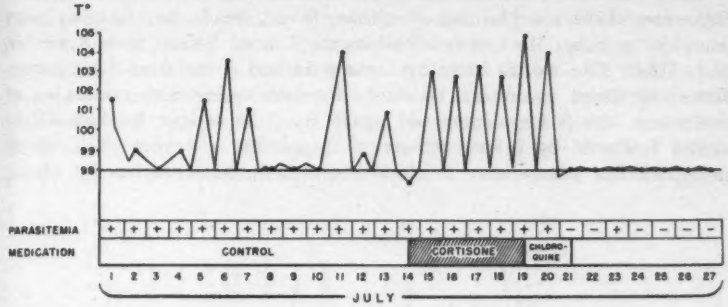

Figure 1. Fever curve of patient 1.

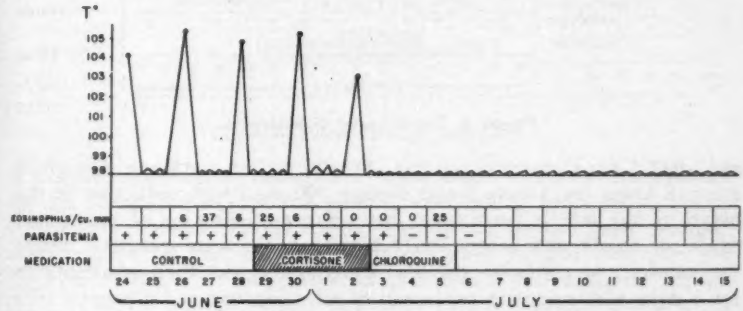

Figure 2. Fever curve of patient 2.

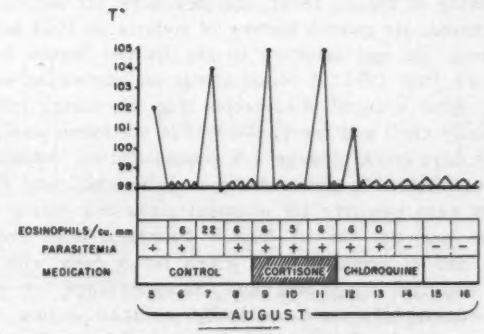

Figure 3. Fever curve of patient 3.

Case 4. A 19-year-old man was admitted to this hospital on 10 September 1951 complaining of chills, fever, headache, malaise, and muscular aching. He had returned to the United States from Korea in May 1951. Two weeks after his return he had a malarial attack confirmed by blood smear and treated with chloroquine with remission of symptoms. On 5 September and again on 7 September he had slight chills followed by fever, and on 10 September a severe chill which prompted his admission. A blood smear was positive for *P. vivax,*

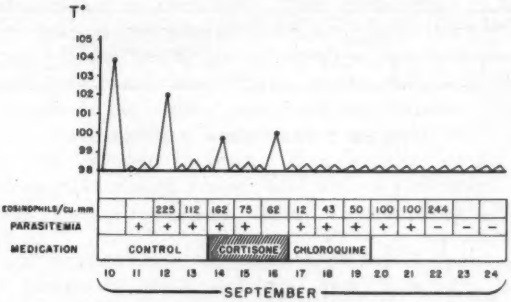

Figure 4. Fever curve of patient 4.

and after 4 days' observation (fig. 4), 100 mg. of cortisone was given every 8 hours for 3 days (total dosage 900 mg.) with reduction in the height of the febrile paroxysms, but without elimination of the tertian cycle of chills and fever. Daily blood smears were positive during the control and cortisone periods. Chloroquine was then administered for 3 days with complete remission of all symptoms and disappearance of parasitemia. Circulating eosinophils were low normal during the control period and markedly reduced during cortisone administration.

Case 5. A 30-year-old man was admitted to this hospital on 6 August 1951 complaining of chills, fever, and headache off and on for 3 days prior to admission. He gave a history of malaria in 1944 while serving in New Guinea. He had returned to the United States from service in Korea on 17 July 1951. A blood smear on admission was positive for *P. vivax.* After 4 days' observation (fig. 5), during which time he exhibited a daily chill and fever, 100 mg. of cortisone was given every 8 hours for 5 days (total dosage 1.4 grams). During cortisone administration he continued to demonstrate a daily chill and fever. Daily blood smears were positive for malarial parasites during the control and cortisone periods. On 16 August treatment with cortisone was discontinued and chloroquine was given for 3 days with prompt remission of malarial symptoms and disappearance of parasitemia. Circulating eosinophils were markedly reduced during the control period and completely disappeared during and immediately following the administration of cortisone.

Case 6. A 21-year-old man was admitted to this hospital on 3 August 1951 complaining of chills, fever, headache, and abdominal pain. He had served in Korea until February 1951 and had had 3 attacks of chills and fever since returning to the United States. He had had 2 courses of antimalarial therapy. A blood smear on admission was positive for *P. vivax*. After 5 days' observation to record a control fever curve (fig. 6), 100 mg. of cortisone was given every 8 hours for 6 days (total dosage 1.6 grams) with concomitant amelioration

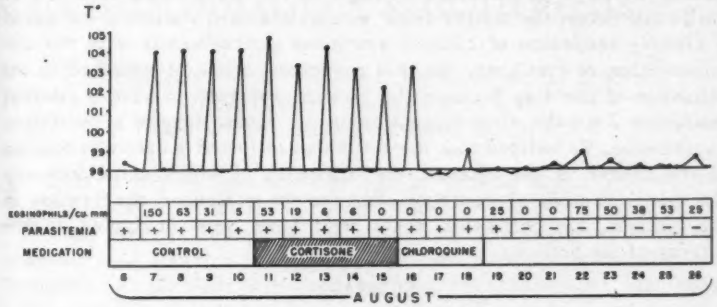

Figure 5. Fever curve of patient 5.

of clinical symptoms. Treatment with cortisone was then discontinued and on the following day the patient went AWOL for 7 days. He returned to the hospital on 21 August stating that he had been asymptomatic except for the day prior to return when he had headache and flank pain which he interpreted as prodromata of a malarial attack. Prior to going AWOL, he had had daily parasitemia, both during the control and cortisone periods. On return, he again had daily parasitemia, but continued to remain asymptomatic. He was then observed for a period of 50 days during which time he continued to have para-

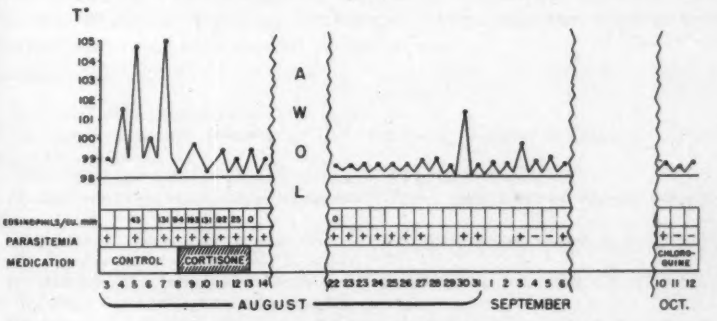

Figure 6. Fever curve of patient 6.

sitemia without frank malarial symptoms. He had a mild fever on only 2 days, and except for these mild abortive reactions, he felt well. He was then treated with chloroquine with disappearance of the parasitemia.

COMMENT

The clinical expression of the disease did not appear to have been appreciably influenced by cortisone in patients 1, 2, 3, and 5. In patient 4, although accompanied by a blunting of the paroxysms of chills and fever, the tertian cycle was maintained. Patient 6 exhibited a striking remission of clinical symptoms concomitantly with the administration of cortisone, but this response cannot be ascribed to the influence of the drug because the patient continued to have a clinical remission 2 months after discontinuing the agent, despite a persistent parasitemia. We believe that the remission reflected a natural variation in the course of the disease, the beginning of which coincided with the administration of cortisone. But for the prolonged observation of the patient, his remission might well have been attributed to the effects of the hormone.

SUMMARY

Six patients with benign tertian malaria in relapse were treated with cortisone daily for periods of from 3 to 6 days to determine the effect of this hormone on the clinical expression of the disease. In 4 patients there was no observable effect on the severity or cyclic nature of the clinical symptoms. In 1 patient, a lessening of the severity of symptoms without alteration of the cyclic course of the disease was noted. The sixth patient apparently went into a natural remission of his disease coincident with the administration of cortisone.

Fatal Lead Poisoning Simulating Poliomyelitis[1]

Andrew F. Braff, *Lieutenant Commander, MC, U. S. N.*
Doss O. Lynn, *Colonel, MC, U. S. A.*
Otto A. Wurl, *Lieutenant Colonel, MC, U. S. A.*

LEAD poisoning may involve any of several organ systems and produce a clinical syndrome simulating another disease (2). The nervous system is one of the more commonly involved systems in lead intoxication and may present varied clinical findings. Westphal (3) divided patients with lead encephalopathy into those with generalized cerebral involvement and those with focal lesions. The former group included patients whose symptoms were suggestive of multiple sclerosis and progressive generalized paralysis. The latter group exhibited signs of isolated cerebral lesions, such as bulbar palsy and involvement of one or more cranial nerves. Lead poisoning simulating the clinical findings of diffuse anterior poliomyelitis has been described by Dejerine-Klumpke (4) and Putnam (5). Hamilton (6) has cited a fatal case simulating ascending paralysis, with progressive involvement of the forearm, tongue, pharynx, and larynx and with clouded mentality. Aub et al. (7) pointed out that the evidence for lead poisoning in many of the reported patients in whom the clinical findings suggested a generalized cord lesion has been far from sufficient. The following case of proved fatal lead poisoning, therefore, was thought worthy of reporting because it emphasizes the ease of confusion with acute bulbo-spinal poliomyelitis.

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(1) Tripler Army Hospital, Honolulu, T. H.

(2) Cantarow, A., and Trumper, M.: Lead Poisoning. Williams & Wilkins Co., Baltimore, Md., 1944.

(3) Westphal, A.: Cited in footnote reference (2). p. 117.

(4) Déjérine-Klumpke, A.: Des Polynevrites, Paris, 1889. Cited in footnote reference (2). p. 134.

(5) Putnam, J. J.: J. Nerv. & Ment. Dis. 10: 466, 1883; Boston M. & S. J. 117: 73, 97, 1887. Cited in footnote reference (2). p. 134.

(6) Hamilton, A.: Industrial Poisons in the United States. Macmillan Co., New York, N. Y., 1925. Cited in footnote reference (2). p. 134.

(7) Aub, J. C.; Fairhall, L.; Minot, A.; and Reznikoff, P.: Lead poisoning. Medicine 4: 1-250, Feb.-May 1925.

CASE REPORT

A 23-year-old man was admitted to this hospital on 10 December 1951 after an illness of 3 weeks' duration. He had been on duty with the Navy in Pacific waters for 4 months. His chief complaints on admission were progressive paralysis involving all extremities and a marked pain in his back and the muscles of his thighs with onset 6 days previously. Twenty-four hours prior to admission he had had difficulty in swallowing and marked dyspnea.

Review of the accompanying Navy Health Record revealed that he had been admitted to the sick bay on 20 November with abdominal pain, nausea, and a temperature of 101.8° F. Acute duodenitis or duodenal ulcer were considered as diagnostic possibilities and he was treated with frequent feedings, aluminum hydroxide, and belladonna. He responded to treatment and was discharged to duty after 4 days. On 4 December he again reported to the sick bay complaining of numbness of his hands and feet. Physical examination was essentially negative; it was specifically recorded that there was no motor weakness, that light touch and superficial and deep pain sensation were intact, and that his reflexes were bilaterally present and equal. On 6 December he developed slight weakness of the lower extremities. No sensory changes were noted although he continued to complain of numbness of the hands and feet. On the following day there was progressive weakness of his legs and of the extensor muscles of his arms. He complained of back pain and pain in the neck on flexion. Cervical rigidity was present. A provisional diagnosis of poliomyelitis or polyneuritis was made.

Lumbar puncture revealed a normal pressure, clear fluid with 7 lymphocytes per cubic millimeter, and a normal Pandy test. His leukocyte count was 8,025 with a normal differential count. His erythrocyte count was 4,100,000. Urinalysis was negative except for 1 plus albumin. He was unable to retain fluids or food and his abdominal discomfort was only slightly relieved by aluminum hydroxide. Codeine was required for relief of the pain in his leg muscles. On 8 December an almost complete flaccid paralysis of his legs, associated with spasm of the hamstring muscles, was noted. There was marked flaccid paralysis of the extensor muscles of his arms. There appeared to be some impairment of sensation of the distal aspect of his legs, but evaluation of this was difficult because of his cloudy sensorium. He complained of severe pain in his back and in the muscles of his face and neck. His condition continued to deteriorate. His respirations became labored. His cloudy sensorium and difficulty in coughing continued and on 10 December he was transferred to this hospital.

Physical examination on admission revealed a thin white man in acute respiratory distress with cyanosis of the lips and fingernails and with prominent activity of the accessory muscles of respiration. His cough was weak and ineffective. Numerous coarse rales were present throughout both lungs. His heart appeared normal in size. His

pulse was 120 and regular. A rough systolic murmur was present over the entire precordium. His muscle strength in both upper and lower extremities was markedly diminished and he was unable to raise his legs against gravity. There was marked peroneal weakness bilaterally. His pharyngeal reflex was diminished. His soft palate moved in the midline. Hypalgesia and hypesthesia over the feet and legs bilaterally were noted by one observer. The patient's dull sensorium, however, prevented accurate evaluation of sensation. His knee and ankle jerks were absent bilaterally and his biceps and triceps jerks were hypoactive. His rectal temperature was 101.6° F.

The specific gravity of the urine on admission was 1.030 and there was 4 plus albumin, many leukocytes, few erythrocytes, and 1 or 2 granular casts per high power field in the urine. The leukocyte count was 27,100 with 84 percent neutrophils, 13 percent lymphocytes, and 3 percent eosinophils. The erythrocyte count was 6,900,000 with a hematocrit of 56 percent. The urea nitrogen was 31 mg. per 100 cc. and the carbon dioxide combining power was 29 volumes per 100 cc. A roentgenogram of the chest showed a slight decrease in the volume of the entire right lung and an area of pneumonitis in its upper lobe.

On admission the patient was immediately placed in a tank respirator with elevation of the foot of the respirator to insure dependent drainage of the tracheobronchial tree. His cyanosis immediately disappeared. Intermittent suction of the nasopharynx was carried out as he seemed unable to swallow. Oxygen was administered by a nasal tube and fluids were given parenterally. On 11 December the patient's speech had a nasal twang and elevation of the soft palate was inadequately performed. The marked weakness of all extremities remained unchanged. Examination of his chest revealed decreased motion of the right hemithorax with markedly diminished breath sounds and a few coarse rales throughout. The right bronchial tree was aspirated through a bronchoscope. A small amount of mucus was recovered, but no obstruction was noted. A rising blood pressure and pulse rate were thought to be indicative of anoxia despite the absence of cyanosis and on 12 December the tracheobronchial tree was again thoroughly aspirated through a bronchoscope. His inability to swallow and cough continued. Because of marked salivation, a tracheotomy was performed concomitantly with the administration of endotracheal oxygen, but the patient died during the procedure.

On gross examination the pathologist noted cyanosis of the nail beds. The heart weighed 335 grams and was normal except for minimal coronary arteriosclerosis and a single 4-mm. area of hemorrhage beneath the endocardium of the left ventricle. The right lung weighed 770 grams and showed extensive bronchopneumonia with large amounts of purulent material in the bronchi. The left lung weighed 410 grams and was normal except for congestion and scattered small foci of recent hemorrhage. The trachea and larynx were congested. The spleen was soft and weighed 145 grams. The cut surface revealed a few small foci

of hemorrhage. The liver weighed 1,960 grams and was normal except for congestion. The kidneys showed only congestion. The cerebral convolutions appeared slightly flattened and the sulci somewhat narrowed. There was slight notching of the unci. Serial sections of the brain revealed marked congestion throughout. There were scattered petechial hemorrhages which were most prominent in the pons and medulla. The spinal cord was congested.

Microscopic examination of the brain and spinal cord showed marked hyperemia throughout. Scattered petechias were present in the brain but absent in the spinal cord. A few hyaline thrombi were seen in the small blood vessels of the cerebellum. Many of the ganglion cells of the brain stem and spinal cord showed chromatolysis and degenerative changes in the nuclei. No neuronophagia, perivascular cuffing, or inflammatory exudate were found. Chemical analysis of the blood postmortem revealed a lead content of 0.5176 mg. per 100 cc.

DISCUSSION

Clinically and at the time of the autopsy, the patient was thought to have had acute bulbo-spinal poliomyelitis and the gross findings at autopsy were compatible with this diagnosis. Microscopic sections of the brain and spinal cord, however, indicated a toxic type of encephalomyelopathy rather than an infectious process. Examination of the blood postmortem revealed a lead content of 0.5176 mg. per 100 cc. and subsequent correspondence revealed that the patient had been employed as a welder and pipe fitter for about 4 months. He had worked on galvanized and sheet metals and had, therefore, been exposed to the fumes of lead, zinc, and arsenic. At no time had he worked in an enclosed area. It had been observed that during his 4 months in this occupation he had had a poor appetite and his intake of food had been small. No fresh milk had been available during this period. Prior to recall to active duty, he had done electrical work, the exact nature of which was unknown.

According to Cantarow and Trumper *(2)* the maximum concentration of lead in the blood compatible with health is 0.08 mg. per 100 cc. Most normal subjects without undue exposure to lead will present values below 0.06 mg. These authors further point out that the concentration of lead in the blood bears no consistent relationship to the appearance or severity of clinical manifestations of lead poisoning. With few exceptions blood levels above 0.1 mg. per 100 cc. are associated with definite lead exposure, but although values in the range exhibited by our patient have been found in occupational lead poisoning with severe clinical manifestations, a single observation of a high concentration of lead in the blood, in the absence of other evidence, cannot be regarded as diagnostic of lead poisoning. On the other hand, a combination of (1) a history of occupational exposure, (2) clinical symptoms compatible with lead poisoning, and (3) a blood lead concentration of the magnitude of 0.5 mg. per 100 cc. (all present in our patient) constitute reasonable proof of lead poisoning.

SUMMARY

Lead poisoning is easily confused with poliomyelitis of the bulbospinal type. Because of its widely variable clinical features, the diagnosis of lead poisoning predominantly affecting the nervous system depends on a high index of suspicion and a history of occupational or inadvertent exposure to lead. The demonstration of abnormal concentrations of lead in the blood or urine is proof of the absorption of excessive quantities into the body and affords laboratory confirmation of utmost diagnostic importance.

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Diseases of the Nervous System, Described for Practitioners and Students, by *F. M. R. Walshe,* M. D., D. Sc., F. R. S., Fellow of the Royal College of Physicians of London; Fellow of University College, London; Consulting Physician to University College Hospital and to the National Hospital for Nervous Diseases, Queen Square. 7th edition. 365 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publisher, 1952. Price $5.50.

The 1951 Year Book of Endocrinology (January 1951-January 1952), edited by *Gilbert S. Gordon,* M. D., Ph. D., Assistant Professor of Medicine, University of California School of Medicine, Assistant Physician, University of California Hospital; Consultant Endocrinologist, Langley Porter Clinic of the State Department of Mental Hygiene, San Francisco, Calif. 415 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., 1952. Price $5.

Normal Blood Pressure and Hypertension, New Definitions, by *Arthur M. Master,* M. D., Cardiologist, Mount Sinai Hospital, New York; and Associate Clinical Professor of Medicine, Columbia University, New York; *Charles I. Garfield,* M. D., Research Assistant in Cardiology, Mount Sinai Hospital, New York, and *Max B. Walters,* M. D., F. R. C. P. (Can.); Member, Heart Station, Vancouver General Hospital, Canada; Formerly Research Assistant in Cardiology, Mount Sinai Hospital, New York. 144 pages; 36 illustrations. Lea & Febiger, Philadelphia, Pa., publisher, 1952. Price $4.

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Surgery of the Chest, A Handbook of Operative Surgery, by *Julian Johnson*, M. D., D. Sc. (Med), Professor of Surgery, School of Medicine and Graduate School of Medicine, University of Pennsylvania, and *Charles K. Kirby*, M. D., Assistant Professor of Surgery, School of Medicine, University of Pennsylvania. Illustrated by *Edna Hill*. 387 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., 1952. Price $9.

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The Clinical and Pathologic Aspects of Appendicitis[1]

Myron E. Rubnitz, *First Lieutenant, MC, U. S. A.*

James L. Hansen, *Lieutenant Colonel, MC, U. S. A.*

FIVE hundred cases of acute surgical abdomen, clinically diagnosed as acute appendicitis, were reviewed at this laboratory. The appendixes in all of these cases were submitted to this laboratory for examination during the period 1 November 1950 through 31 July 1951. The patients were civilian dependents and military personnel stationed at U. S. Army and U. S. Air Force installations located within the First Army Area and adjacent island bases. The majority of patients, military personnel, were young adult males. The average age of the patients from whom the appendixes were removed was 21.9 years (range 2 to 58) *(2)*.

Of the 500 cases reviewed, 343 were diagnosed on microscopic examination as acute appendicitis (8 of these appendixes were perforated); 90 showed no evidence of disease and were, therefore, diagnosed as normal appendixes; 54 were variously diagnosed as fibrosis of the appendix, scarred appendix, chronic appendicitis, and subacute appendicitis; 9 appendixes contained fecaliths and did not otherwise show any inflammatory changes; 3 showed parasitic infestation; and 1 was a carcinoid of the appendix in which a mucocele was also demonstrated on both gross and microscopic examinations.

Leukocyte counts were reported in 237 of the 500 clinical abstracts received. One hundred and sixty-one patients (68 percent) who had elevated leukocyte counts showed evidence of acute appendicitis. Sixty-two patients (26 percent) with elevated leukocyte counts did not show evidence of acute appendicitis. The remaining 14 had normal leukocyte counts. Examination of the appendixes of 5 of these 14 patients did, however, reveal acute inflammation. The leukocyte count was found to be an adjunct to an accurate clinical diagnosis in 71.7 percent of the cases, while in 28.3 percent it was noncontributory.

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(1) First Army Area Medical Laboratory, New York, N. Y.

(2) This was based on 453 clinical abstracts because 47 did not include the patient's age.

Time intervals. The clinical abstracts in 290 cases, microscopically diagnosed as acute appendicitis, indicated the time intervals between the onset of symptoms and appendectomy. In no instance was a patient operated on before 3 hours had elapsed. Seventy-five percent of them were operated on during the first 24 hours. Appendectomies were performed in 96.2 percent of the patients within 72 hours following onset of symptoms. The longest period of time to elapse between onset of symptoms and appendectomy was 1 week.

Age groups. Although most (385) of the patients were in the age group of 17 to 35 years, 44 were 16 years of age or less and 24 were 35 years of age or over. Of those under 17 years of age, 29 showed microscopic evidence of acute appendicitis. In 2 of these 29 patients, the appendixes had perforated. This represents a slightlv higher percent of perforation than that for the entire group of 343 patients with acute appendicitis. One of the patients with perforation was a 5-year-old boy who had been given a cathartic. A 3-year-old boy was given a cathartic after complaining of low abdominal pains. His appendix was acutely inflamed but fortunately had not perforated. In this group of 44 patients, not over 16 years of age, 2 showed parasitic infestation in the appendix. This is a higher percent than that for the entire group of 500 cases reviewed. Of the 24 patients over 35 years of age, 17 showed microscopic evidence of acute inflammation. This is only a slightly higher percent than that for the entire group of 343 patients with acute appendicitis.

Mesenteric lymphadenitis. Of the 500 cases reviewed, 9 were found to have mesenteric lymphadenitis at the time of operation. Two had acute appendicitis with accompanying lymphadenitis. Of the other 7, 4 showed normal appendixes, 2 had chronic appendicitis, and 1 showed merely a fecalith in the appendix. Five of the 7 patients had leukocyte counts ranging between 10,800 and 26,000.

Interesting clinical and pathologic findings. Fourteen patients had unusual clinical and/or pathologic findings. Two 11-year-old patients had pinworms in the lumen of the appendix, and a 19-year-old woman, who showed evidence of a pelvic inflammatory disease, had an appendiceal parasitic granuloma. Two other patients were discovered at operation to have pelvic inflammatory disease. The appendix in one was normal. The other, a 20-year-old woman had both acute appendicitis and salpingitis. Two patients had sickle cell crises simulating attacks of acute appendicitis. In each of these patients, although the leukocyte counts were 17,000 and 18,400 respectively, the appendix was normal. A clinical diagnosis of tubal pregnancy was made in a 30-year-old woman whose fallopian tubes at operation were normal but whose appendix was acutely inflamed. A twisted ovarian cyst, not uncommonly seen as the cause of severe lower abdominal pains, was removed from a 17-year-old girl who had had symptoms for 2 months prior to operation. Her appendix was normal. Inflammatory changes and anomalies about the ileocecal region caused lower abdominal pains in

4 patients in whom a clinical diagnosis of acute appendicitis was made. Pathologic examination proved 1 of these patients, a 28-year-old man who complained of pain in the right lower abdominal quadrant of 1 year's duration, to have regional ileitis. In 2 of the 4 patients, Meckel's diverticula were found. In the fourth (a 31-year-old man) 2 perforations which were caused by a bone sliver were discovered at the ileocecal junction. One of the most unusual cases was that of a 24-year-old man who was instantaneously killed in an automobile accident. During the course of the autopsy, a grossly inflamed appendix was encountered. Microscopic examination substantiated the diagnosis of acute appendicitis. The relationship between the inflammation of the appendix and the automobile accident could not be determined.

Correlation between gross and microscopic examinations of appendixes. Three hundred and twenty of the 500 cases reviewed showed gross evidence of acute appendicitis. Only 308 of these also showed microscopic evidence of acute inflammation. Of the remaining 180 appendixes, which grossly did not appear to be acutely inflamed, 35 (19.5 percent) showed microscopic evidence of acute appendicitis.

Variations in the position of the appendix. The appendix was found in abnormal positions in 19 patients. Fifteen (79 percent) of these had acute appendicitis. This is a substantially higher percent than that of the series as a whole (68.6 percent). Three of these 19 appendixes were grossly and microscopically normal and 1 was diagnosed as subacute appendicitis. Of these 19 appendixes, 17 were in a retrocecal position, 1 was found in a hernial sac, and 1 was found in the left upper abdominal quadrant of a 19-year-old man. The clinical abstract accompanying this last specimen indicated symptoms of acute appendicitis with severe abdominal pains referred to the left upper abdominal quadrant.

SUMMARY

Of 500 cases submitted to this laboratory with a clinical diagnosis of acute appendicitis, 68.6 percent were found to have microscopic evidence of acute appendicitis. Normal appendixes were found in 18 percent. Three patients had parasitic infestations of the appendix and 1 revealed both a carcinoid and mucocele in the appendix. About 72 percent of the patients showed a positive correlation between the leukocyte counts and the microscopic diagnoses. Over 75 percent of the patients with confirmed acute appendicitis were operated on within the first 24 hours after the onset of symptoms. A variation from the normal position of the appendix was noted in 19 patients. About 80 percent of this group were acutely inflamed. Positive correlations were found between the gross descriptions and microscopic findings in almost 91 percent of all appendixes examined.

BOOK REVIEW

The 1951 Year Book of Dermatology and Syphilology (December 1950-November 1951), edited by *Marion B. Sulzberger*, M. D., Professor and Chairman, Department of Dermatology and Syphilology, New York University Post-Graduate Medical School; Director of Dermatology and Syphilology, Skin and Cancer Unit and University Hospital, New York University-Bellevue Medical Center, and *Rudolf L. Baer*, M. D., Associate Professor of Clinical Dermatology and Syphilology, New York University Post-Graduate Medical School; Associate Director, Skin and Cancer Unit, and Attending Dermatologist, New York University Hospital. 476 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., 1952. Price $5.50.

The importance of this Year Book on dermatology and syphilology lies in the statement of the editors in the first paragraph of their leading article, "Some Common Errors in the Management of Skin Diseases": "It appears that not only most laymen but even many physicians are unaware that skin diseases today account for about one of every five to seven cases seen in the offices of general practitioners in this country."

The value of this type of a book lies in bringing together a large number of articles in a compact, digested form. The listing of articles by title and a separate listing of authors make for easy finding of an article which the physician may remember as having been published. Frequently the title is forgotten but the year and author are recalled.

Review of foreign articles is undertaken and is an excellent feature of the Year Book. Confronted with language barriers and frequent unavailability of foreign journals, the average physician would probably not be aware of these excellent reports were it not for the editors' contribution of these reviews.

The book comprises a varied range of subjects. The chapter on treatment and prevention is extensive and reviews current treatment of skin diseases with ACTH, cortisone, antibiotics, and hormones. The section on tumors of the skin is noteworthy in the presentation of such subjects as familial primary self-healing squamous epithelioma of skin and metastasizing basal cell epithelioma of skin. To the busy practitioner who wants to keep up, the section on investigative studies is a ready reference.—*Capt. W. N. New, MC, U. S. N.*

Cortisone in the Treatment of Friedländer's Pneumonia

Evan K. Perkins, *Captain, U. S. A. F. (MC)* (1)

Jack T. Turpin, *Captain, U. S. A. F. (MC)* (1)

THE role of the adrenal cortex in the body's defense against infectious disease has long been suspected. Animals subjected to adrenalectomy have died following experimentally induced infections while control animals with intact adrenal glands survived the same infections. Adrenocortical extracts have raised the resistance of the adrenalectomized animals nearly to the level of resistance demonstrated by the controls (2). Kass et al. (3), in their studies in patients with pneumonia, implied that the stress of infection increases the tissue demand for adrenal cortical hormones. Because Friedlander's pneumonia is frequently accompanied by the stress of an overwhelming toxemia and because it may be associated with necrosis of the adrenal cortex, it was considered that cortisone might be used as a supportive measure in the treatment of this disease (4).

CASE REPORT

A 36-year-old man was admitted to this hospital on 1 October 1951 after having been found in a dazed, semistuporous state. He was completely disoriented and unable to give any history.

Physical examination on entry revealed an emaciated, flushed, perspiring man in acute respiratory distress with a rectal temperature of 104° F., a pulse rate of 90, a respiratory rate of 45, and marked flaring of the alae nasi. The conjunctivas were intensely suffused and the pharynx was moderately injected. Examination of the chest revealed respiratory lag and decreased breath sounds over the right

(1) U. S. Air Force Hospital, Fairchild Air Force Base, Fairchild, Wash.

(2) Perla, D., and Marmorston, J.: Natural Resistance and Clinical Medicine. Little, Brown & Co., Boston, Mass., 1941. p. 490.

(3) Kass, E. H.; Ingbar, S. H.; and Finland, M.: Effects of adrenocorticotropic hormone in pneumonia; clinical, bacteriological and serological studies. Ann. Int. Med. 33: 1081-1098, Nov. 1950.

(4) Pomerantz, H. Z.; Wasserman, E.; and Katz, K. H.: Friedländer's pneumonia. Boston Med. Quart. 2: 23-28.

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upper posterior portion of the chest. The liver was enlarged 6 cm. below the right costal margin and had a firm, smooth edge. The extremities were poorly muscled and numerous spider angiomas, which blanched on pressure, were noted over the upper thorax and neck.

The leukocyte count was 5,700 with 89 percent neutrophils (most of which showed toxic granulation), 10 percent lymphocytes, and 1 percent monocytes. The hematocrit was 37 percent and the hemoglobin 13.2. Urinalysis revealed 4 plus albuminuria and the sediment contained innumerable leukocytes. A smear and culture of the pharynx failed to demonstrate any pathogenic organisms and no sputum was produced until the second hospital day when Friedländer's bacilli were recovered on 2 successive days. A roentgenogram of the chest revealed dense consolidation of the entire upper lobe of the right lung.

Five grams of sulfadiazine were given intravenously followed by 2.5 grams every 8 hours. In addition, 100,000 units of crystalline penicillin were administered intramuscularly every 3 hours. Dextrose solution was given intravenously and vitamin B complex was also administered parenterally on entry. The patient became rapidly worse and 8 hours after admission was unresponsive and appeared moribund. The leukocyte count at this time was 3,800. Fifty mg. of cortisone were given intramuscularly and this was repeated twice daily for 2 days in addition to the other measures mentioned. Four hours after cortisone therapy was started, the patient had improved dramatically. The respiratory rate had fallen to 32 per minute, the rectal temperature had fallen to 100.6° F., and the patient was more responsive. On the following day his rectal temperature was 99.8° F.; his respiratory rate was 20; and he was lucid and able to take fluids by mouth. He began coughing up thick, bloody sputum and definite physical signs of consolidation in the upper lobe of the right lung developed.

On the second day, the sulfadiazine dosage was reduced to 1 gram every 6 hours by mouth. On the following day, the procaine penicillin dosage was reduced to 300,000 units twice daily and this was continued for 8 days. The subsequent course was one of progressive improvement with lysis of the pulmonary consolidation and gradual rise of the leukocyte count to 14,500 on the eighth hospital day. The angiomas had disappeared by the third hospital day. The patient was discharged afebrile and asymptomatic on 2 November 1951.

DISCUSSION

Although this patient received only small doses of cortisone, the dramatic and prompt response after administration of this agent was impressive. There was a noticeable improvement in the clinical appearance within 4 hours after the drug was first administered.

Degeneration of the adrenal cortex has been demonstrated in overwhelming infections. Rich *(5)* discusses cases of tubular degeneration of the adrenal cortex (zona fasciculata), found in severe infections with meningococcus, pneumococcus, streptococcus, and diphtheria organisms and associated with circulatory collapse of unexplained origin. Pomerantz et al. *(4)*, in their analysis of Friedlander's pneumonia, discussed a case which at autopsy showed microscopic degeneration of the adrenal cortical cells with infiltration of polymorphonucleocytes and small areas of hemorrhage in the cortex and medulla.

There is some lack of agreement as to the beneficial effects of cortisone in severe infections. In reference to pneumococcic pneumonia, Kinsell *(6)* suggests that the administration of ACTH or cortisone may be a lifesaving procedure in debilitated patients who fail to respond adequately to chemotherapy, but Glaser et al. *(7)* produced streptococcal and pneumococcal pneumonia in rats and noted that the survival rates were less favorable among the animals treated with cortisone. Adrenal-stimulating agents or adrenal cortical steroids cannot be considered as substitutes for specific anti-infective therapy *(8)*.

SUMMARY

A patient with Friedländer's pneumonia, treated with cortisone and specific antimicrobial therapy, made a dramatic recovery.

(5) Rich, A. R.: Peculiar type of adrenal cortical damage associated with acute infections, and its possible relation to circulatory collapse. Bull. Johns Hopkins Hosp. 74: 1-15, Jan. 1944.

(6) Kinsell, L. W.: Clinical application of pituitary adrenocorticotropic and adrenal steroid hormones. Ann. Int. Med. 35: 615-651, Sept. 1951.

(7) Glaser, R. J.; Berry, J. W.; Loeb, L. H.; and Wood, W. B., Jr.: Effect of cortisone on acute bacterial infections. J. Clin. Investigation 30: 640, 1951.

(8) ACTH and cortisone in infection. (Editorial) New England J. Med. 245: 75-77, July 12, 1951.

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Culdoscopy, A New Technic in Gynecologic and Obstetric Diagnosis, by *Albert Decker,* M. D., D. O. G., F. A. C. S., Clinical Professor of Gynecology and Obstetrics, New York Polyclinic Medical School and Hospital; Associate Attending Physician in Gynecology and Obstetrics, New York Polyclinic Hospital; Attending Gynecologist, Knickerbocker Hospital, with a Foreword by *Richard W. TeLinde,* M. D. 148 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., publisher, 1952.

The Treatment of Injuries to the Nervous System, by *Donald Munro,* M. D., F. A. C. S., Surgeon-in-Chief, Department of Neurosurgery, The Boston City Hospital; Associate Professor of Neurosurgery, Boston University School of Medicine; Assistant Professor of Neurosurgery, Harvard University Medical School. 284 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., 1952.

Correlative Cardiology, An Integration of Cardiac Function and the Management of Cardiac Disease, by *Carl F. Shaffer,* M. D., F. A. C. P., Associate Professor of Clinical Medicine, Baylor University College of Medicine, and *Don W. Chapman,* M. D., F. A. C. P., Associate Professor of Medicine, Baylor University College of Medicine. 525 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., publisher, 1952.

Nursing Care of Communicable Diseases, Prophylactic Technics for the Prevention and the Control of Disease, by *Mary Elizabeth Pillsbury* and *Elizabeth Johanna Sachs.* Science Adviser and Editor, *Jean Broadhurst.* Contributors: *Jessie Wright* and *Jane Taylor Torrance.* 7th edition. 843 pages; illustrated. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1952.

Right Lower Quadrant Pain

Paul M. Burke, *First Lieutenant, U. S. A. F. R. (MC)* (1)

DURING a 3-week period in November 1951, 3 unusual cases of acute right lower abdominal quadrant pain were observed in a 50-bed U. S. Air Force Hospital in Germany.

CASE REPORTS

Case 1. A 34-year-old woman was admitted to the hospital on 8 November 1951. About 6 hours prior to admission, she had suddenly developed acute, diffuse lower abdominal pain which was worse in her right lower quadrant. It would last for about 10 minutes, completely disappear for a few minutes, and then return. At times pain was also felt throughout both sides of her upper abdomen and was associated with vomiting and nausea which tended to relieve the pain. Her bowel movements were essentially normal and there was no history of melena. She had had a brief attack of similar abdominal pains 4 days prior to admission which had awakened her from a sound sleep, but which was relieved immediately by a bowel movement. She had noticed occasional mild attacks of indigestion following the ingestion of fatty and fried foods for the past several years. An active duodenal ulcer was diagnosed in November 1949 but she had been without symptoms since July 1950. Her past history also revealed an appendectomy in 1940 and a right salpingo-oopherectomy for an ovarian cyst in 1946.

On admission she appeared severely ill and dehydrated. She had generalized abdominal tenderness which was more pronounced in the region of her appendectomy scar. Involuntary muscle spasm was present throughout the lower abdomen and peristaltic rushes, which were associated with an accentuation of her pain, were observed. Gas was passed freely by rectum. Rectal examination revealed high, bilateral tenderness. Her leukocyte count was 14,000 with 88 percent neutrophils. The urine sediment contained a few white blood cells. Flat and upright roentgenograms of the abdomen revealed a small area of calcification in the right upper quadrant suggestive of a gallstone.

The patient was given fluids intravenously. Her admission temperature of 99.4° F. increased to 101° F. Her leukocyte count increased to 20,000 with an unchanged differential count. Her condition had deteriorated. A tentative diagnosis of partial intestinal obstruction was

(1) 85th Medical Group.

made and it was decided to perform an exploratory laparotomy. The abdomen was opened and the patient was found to have an early acute regional enteritis involving about 5 feet of the distal ileum with about 1 foot of normal ileum between the diseased segment and the ileocecal valve. The wound was closed without further surgical procedure.

This patient improved rapidly following the operation. She had a low grade fever on the first 2 postoperative days, but was afebrile thereafter. She was discharged on a bland, low-fat diet on her tenth postoperative day. She continued to have an occasional mild ache in her right lower abdominal quadrant but otherwise was asymptomatic.

Comment. This is a typical case of acute regional enteritis with the usual history suggestive of a combination of acute appendicitis and intestinal obstruction. The disease is not common as in a 30-year period at the Geisinger Memorial Hospital, Foss and Barnes *(2)* reported only 17 cases in 50,000 sugical admissions. Only 3 of these were in the acute form.

No definitive operation should be performed on a patient with an acute, but otherwise uncomplicated regional enteritis. The use of resections and short circuiting procedures is reserved for the more chronic forms of the disease. We were concerned that this patient might develop a small bowel perforation during her postoperative period, but Hawthorne and Frobese *(3)* stated that these usually occur late in the course of the disease.

It is debatable whether an appendectomy should be performed on such acute cases. Our patient had previously had her appendix removed. Garlock *(4)* and Cave *(5)* believed that an appendectomy at this time invites the formation of a postoperative fistula, but Pratt and Ferguson *(6)* believed that an infected appendix may be an etiologic factor in the production of regional enteritis and that an appendectomy should be performed. Because of the possibility of fistula formation it is probably better not to remove the appendix.

This woman has only a fair chance of complete recovery. Pugh *(7)* has reported 17 cases of regional enteritis at the U. S. Naval Hospital, San Diego, Calif., of which at least 9 appear to have been the acute

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(2) Foss, H. L., and Barnes, W. T.: Segmental ileitis. Ann. Surg. 133: 651-664, May 1951.

(3) Hawthorne, H. R., and Frobese, A. S.: Chronic stenosing regional enteritis—surgical pathology and experience in surgical treatment. Ann. Surg. 130: 233-241, Aug. 1949.

(4) Garlock, J. H.: Present status of problem of regional ileitis. Am. J. Surg. 72: 875-878, Dec. 1946.

(5) Cave, H. W.: Inflammatory lesions of small intestine; surgical aspects. J. A. M. A. 127: 456-458, Feb. 24, 1945.

(6) Pratt, G. H., and Ferguson, L. K.: Cicatrizing enterocolitis. Am. J. Surg. 73: 28-36, Jan. 1947.

(7) Pugh, H. L.: Regional enteritis. Ann. Surg. 122: 845-861, Nov. 1945.

type. He stated that 3 of these recovered spontaneously although the duration of their follow-up is not known. Of 11 patients with acute ileitis, Crohn *(8)* reported that 8 did poorly and eventually required a second operation.

Case 2. A 19-year-old man was admitted on 21 November 1951 complaining of anorexia, nausea, and constant right lower abdominal quadrant pain of 48 hours' duration. He vomited once at the onset and had 4 or 5 watery stools in the 18 hours immediately preceding admission. His temperature was 100.2° F. and his leukocyte count was 19,650 with 75 percent neutrophils and 25 percent lymphocytes.

A laparotomy was performed shortly after admission. The patient was found to have an acute inflammatory reaction of the cecum extending from the region of the ileocecal valve distally up the cecum for a distance of about 8 cm. The omentum was injected and contained numerous small white plaques scattered throughout its distal part. There was much serous fluid free in the peritoneal cavity. The appendix was slightly distended and questionably injected, but was considered to be clinically normal. A specimen of omentum and of peritoneal fluid were removed for examination. The area of the cecum in the immediate vicinity of the base of the appendix was normal and, after much debate, the appendix was removed. Pathologic examination of the appendix revealed focal suppuration and necrosis of the inner layer of the mucosa and a diagnosis of acute suppurative focal appendicitis was made. The omentum showed early inflammatory congestion. The cultures of peritoneal fluid were negative.

The patient had an uneventful postoperative course and was discharged on convalescent leave on his tenth postoperative day.

Case 3. A 27-year-old man was admitted on 26 November 1951. He was well until 72 hours prior to admission when he developed anorexia. This was followed in 48 hours by abdominal pain of moderate severity which was persistent in nature and localized in the right lower quadrant and in the region of the umbilicus. He did not vomit, but had 3 or 4 loose stools in the 36 hours prior to admission. Past history revealed that he had had infectious hepatitis in 1944 and that several months prior to admission he had had some vague abdominal pains. These did not force him to cease work and left him completely after several days.

Positive physical findings were confined to the abdomen where he had tenderness at McBurney's point with mild spasm and rebound tenderness. His temperature was 98° F. His leukocyte count on admission was 13,150 with 82 percent neutrophils, 16 percent lymphocytes, 1 percent eosinophils, and 1 percent monocytes.

A laparotomy was performed shortly after admission. The patient was found to have an old appendiceal abscess adherent to the terminal

(8) Crohn, B. B.: In Portis, A. A. (editor): Diseases of the Digestive System. 2d edition. Lea & Febiger, Philadelphia, Pa., 1944. p. 503.

ileum and cecum. It measured about 10 cm. in diameter with a wall about 2 cm. thick and contained about 12 cc. of pus. The appendix could not definitely be identified. The pus was evacuated and a large Penrose drain was inserted into the abscess cavity and brought out through a stab wound in the right flank.

Aside from a temperature of 102° F. on the first postoperative day, the patient had an uneventful hospital course. His drain was removed on the eighth day and he was discharged on convalescent leave on his twelfth postoperative day.

Comment. This case is reported because of the lack of history of appendiceal disease associated with a perforated abscessed appendix.

BOOKS RECEIVED

Progress in Ophthalmology and Otolaryngology, A Quadrennial Review, Volume I, Part One, Ophthalmology, edited by *Meyer Wiener,* M. D., and *A. Edward Maumenee,* M. D. Part Two, Otolaryngology, edited by *Percy E. Ireland,* M. D., and *Joseph A. Sullivan,* M. B. 666 pages; illustrated. Grune & Stratton, New York, N. Y., publishers, 1952. Price $15.

Rorschach's Test, III. Advances in Interpretation by *Samuel J. Beck,* Ph. D., Institute for Psychosomatic and Psychiatric Research, Michael Reese Hospital, Chicago; Departments of Psychology, University of Chicago and Northwestern University. 301 pages. Grune & Stratton, New York, N. Y., publishers, 1952. Price $5.50.

Skin Therapeutics, Prescription and Preparation (Materia Medica Dermatologica) by *M. K. Polano,* Head of the Dermatological Department, Municipal Hospital, the Hague (Netherlands) with an introduction by *Clarence S. Livingood,* Professor of Dermatology, the University of Texas, Galveston (Tex., U. S. A.) 276 pages. Elsevier Publishing Co., New York, N. Y., 1952. Price $6.50.

Collected Papers of the Mayo Clinic and the Mayo Foundation, edited by *Richard M. Hewitt,* B. A., M. A., M. D.; *A. B. Nevling,* M. D., *John R. Miner,* B. A., Sc. D.; *James R. Eckman,* A. B., M. A., Ph. D., *M. Katharine Smith,* B. A.; *Carl M. Garbill,* A. B., M. D., M. P. H., and *Florence Schmidt,* B. S. E. Vol. XLIII, 1951. 833 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., 1952.

Diseases of the Nervous System in Infancy, Childhood and Adolescence, by *Frank R. Ford,* M. D., Associate Professor of Neurology, The Johns Hopkins University, Baltimore, Md. 3d edition. 1,181 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1952. Price $18.50.

Sensitivity to Ointments Containing Wool Fat

Howard K. Schwarzfeld, *Commander, MC, U. S. N. R. (1)*

REPORTS of cutaneous sensitivity to lanolin and aquaphor are not new, but periodic re-examination of the incidence of hypersensitivity to these substances is necessary in order to assess its practical importance. Although Ellis' (2) work on wool fat and cholesterol dermatitis may have given some physicians the impression that allergic eczematous contact dermatitis due to lanolin or aquaphor is rather common, it contains no statement that can be construed to mean that lanolin or aquaphor dermatitis is common. The incidence of contact-type sensitivity to these substances is low. Only 3 or 4 cases of lanolin and aquaphor sensitivity are found in about 2,500 series of tests with topical therapeutic materials, representing a total of about 50,000 patches with topical agents.

Crude wool fat was known for centuries but was too disagreeable for use until Liebrich (3) introduced the purified product as lanolin. Lanolin is wool fat with from 25 to 30 percent water. Adeps lanae (anhydrous lanolin) is composed of the sterols and fatty acids derived from the soapy, greasy liquors obtained from the scouring of the raw wool of sheep (4). Lanolin is pale yellow, sticky, has a slightly disagreeable odor, and is analogous to human sebum. Aquaphor contains the sterols and fatty acids derived from wool fat. To 6 parts of this mixture of substances from wool, 94 parts of petroleum hydrocarbons are added. The resultant is the ointment base known as aquaphor, which has a greater water-absorbing capacity than lanolin.

Ramirez and Eller (5) and Sulzberger and Morse (6) were among the first in this country to describe cases of allergic sensitization

(1) U. S. Naval Air Station, Floyd Bennett Field, Brooklyn, N. Y.

(2) Ellis, F. A.: Allergic contact dermatitis due to wool fat and cholesterol. Arch. Dermat. & Syph. 56: 801-806, Dec. 1947.

(3) Liebrich: quoted by Sollmann, T.: A Manual of Pharmacology. 5th edition. W. B. Saunders Co., Philadelphia, Pa., 1936. p. 130.

(4) Arny, H. V., and Fischelis, R. P.: Principles of Pharmacy. 4th edition. W. B. Saunders Co., Philadelphia, Pa., 1943.

(5) Ramirez, M. A., and Eller, J. J.: "Patch" test in "contact dermatitis" (dermatitis venenata). J. Allergy 1: 489-495, Sept. 1930.

(6) Sulzberger, M. B., and Morse, J. L.: Hypersensitiveness to wool fat; report of 2 cases. J. A. M. A. 96: 2099-2100, June 20, 1931.

to lanolin. Their patients had a dermatitis of the hands and upper extremities. The symptoms disappeared on withdrawal of lanolin medication and the avoidance of contact with wool. Patch tests to lanolin were positive. The authors concluded that their cases were of practical importance because of the frequency with which lanolin is prescribed and used and because some patients may have responded poorly to therapy due to an underlying sensitivity to lanolin. Fanburg (7) also pointed out that dermatitis caused by an ointment may often be due to the sterol-containing base rather than other ingredients. He cited an example of contact dermatitis of the scalp due to aquaphor as the ointment base. His patient showed positive patch tests to "purified cholesterol esters" derived from lanolin, but patch tests to lanolin itself were negative.

The present report is based on a study of the records of 10 patients. Two were sensitive to both lanolin and aquaphor; 4 were sensitive to lanolin alone; and 4 were sensitive to aquaphor alone (table 1). Fortunately we were able to do additional patch tests in 4 of these patients. The following case history is representative.

CASE REPORT

A 58-year-old white man was first seen on 24 March 1949 when the diagnosis of dermatitis venenata was considered. The dermatitis present at that time appeared in December 1948 but a previous episode had occurred early in 1947. Examination showed thickening, erythema, and desquamation of the skin of both hands and forearms. In the next few weeks, after medicating with Burow's emulsion which contains 10 percent lanolin, increased inflammation with much oozing and crusting made it necessary to admit the patient to the hospital on 12 April. At that time he presented an erythematous scaly dermatitis with oozing and crusting involving his face, ears, back, abdomen, and all extremities. Improvement was obtained with wet dressings and 40 percent zinc oxide in olive oil. Exacerbations ensued from applications of boric acid ointment, nivea oil, and aquaphor. Patch tests showed 3 plus eczematous reactions to aquaphor and lanolin, 1 plus to boric acid ointment, 2 plus to nickel sulfate, and 1 plus to 5 percent sulfathiazole ointment. By 14 May this patient had greatly improved and was discharged from the hospital. He was instructed to avoid all of the substances that he had reacted to on the patch tests.

DISCUSSION

The dermatitis in this case may have been initiated by nickel, contact with wool, or contact with some unknown substance. There is no doubt that the use of lanolin-containing medicaments caused a marked increase in the severity and extent of the dermatitis. It was not until this was recognized that the dermatitis could be brought under control.

(7) Fanburg, S. J.: Dermatitis due to aquaphor; report of case. Arch. Dermat. & Syph. 42: 479-480, Sept. 1940.

TABLE 1. *Results of patch tests in 10 patients*

Patient	Lanolin	Aquaphor	Cholesterol crystals (U.S.P.)	Cholesterol 10 percent in mineral oil	Lipids derived from lanolin and used to make aquaphor	35 percent cholesterol and oxycholesterins from lanolin in peanut oil	Petrolatum
1	3+	3+	0	0	3+	0	0
2	2+	0	0	0	0	0	0
3	0	2+	0	0	2+	0	0
4	0	2+	0	0	2+	0	0
5	+	0	–	–	–	–	–
6	0	2+	–	–	–	–	–
7	0	2+	–	–	–	–	–
8	+	2+	–	–	–	–	–
9	3+	0	–	–	–	–	–
10	+	0	–	–	–	–	–

0 = no reaction.
– = no patch test made.

Ellis (2), in his series of 9 patients with contact dermatitis due to wool fat and cholesterol, found that they all reacted to patch tests with aquaphor and lanolin and 8 reacted to cholesterol. Because cholesterol is the substance common to both aquaphor and lanolin, it may be the sensitizer involved. Fanburg (7) reported that the sensitivity in his patient was due to the purified cholesterol esters in aquaphor, but a patch test with lanolin gave a negative reaction. The findings in my group of patients (table 1) differ from those reported by Ellis. It is significant that only 2 of the 10 patients in my series reacted to a factor common to both lanolin and aquaphor and that in the other 8 the sensitizer was distinct and different in 4 from that in the remaining 4. Of the 4 patients that were recalled and patch tested, none reacted to pure cholesterol either in the crystalline form or as a suspension in mineral or peanut oil. If cholesterol were the simple common denominator, all patients should have reacted to lanolin, aquaphor, and purified cholesterol.

Cholesterol is a levorotatory sterol that is an important constituent of animal tissues (8). The adult human brain contains 2 percent; sebum, 2.8 percent; hand sweat, 1.4 percent; and stratum corneum, 19.6 percent of cholesterol. Commercially, cholesterol is extracted from the central nervous system of cattle. The alpha-rotatory isocholesterol has 1 less carbon atom in its molecule and many chemical properties different from those of cholesterol which is unstable in the presence of light and oxygen, changing to a lower melting point and to a darker color as it is converted to oxycholesterol and other products of oxidation. Lanolin, on standing, forms decomposition products of cholesterol as well as oxycholesterol and isocholesterol. Because cholesterol is unstable in the presence of light and oxygen, the lanolin and aquaphor used in patch tests contain a number of different cholesterol derivatives, any one of which could be the contact agent involved in that particular case. I believe that the sensitizer involved may not be the same in each case. This explains some of the inconsistencies in the results obtained by other observers in testing patients for sensitivity to lanolin and aquaphor. Depending on the age of the substance and perhaps also on the method of its preparation, the individual sample of lanolin and aquaphor may contain different quantities and derivatives of cholesterol.

New products appearing almost daily on the market are recommended because "they are lanolized." A survey revealed hundreds of products containing lanolin. These included hand creams, soaps, shampoos, sun tan oils, shaving creams, hair tonics, shoe polishes, and many others. Occult exposure to such substances as lanolin can be of tremendous importance to the allergic patient (6). In addition, the U. S. Pharmacopoeia (9) in its thirteenth revision has incorporated

(8) Mathews, A. P.: Physiological Chemistry: A Text-Book for Students. 6th edition. Williams & Wilkins Co., Baltimore, Md., 1939.

(9) The Pharmacopoeia of the United States of America. 13th revision. Mack Publishing Co., Easton, Pa., 1947.

lanolin in many of its official ointments, including ammoniated mercury, belladonna, boric acid, chrysarobin, coal tar, cupric citrate, ethyl aminobenzoate, strong mercurial, mild mercurial, phenol, pine tar, sulfur, tannic acid, white, yellow, yellow mercuric oxide, and zinc oxide ointments.

CONCLUSIONS

Although sensitivity to sterol-containing ointments is not common at present, it may become more frequent in years to come because the public, due to increased contact, will have had more opportunity for sensitization. The present incidence of contact sensitivity to sterol-containing ointments is remarkably low, being below 0.2 percent of a selected group of patients.

Some cases of eczematous contact-type dermatitis can be caused, aggravated, or maintained because of hypersensitivity to lanolin and related compounds. In some patients rapid improvement follows removal of the offender; in others recovery may be delayed because of traces of wool fat in clothing or other hidden exposures.

BOOK REVIEWS

Preventive Medicine and Public Health, by *Wilson G. Smillie,* A. B., M. D., D. P. H., Sc. D. (Hon.), Professor of Public Health and Preventive Medicine, Cornell University Medical College, New York, N. Y. 2d edition. 603 pages; illustrated. The Macmillan Co., New York, N. Y., publisher, 1952. Price $7.50.

The author has revised and brought up to date the first edition which was published in 1946. In his preface to the first edition, he stated that the book was prepared as an introduction of medical students to a *point of view,* and not for professional public health personnel. This concept was reiterated in many places throughout the text by emphasizing the part that the practicing physician should play in a public health program. Despite the author's modesty in describing this treatise as a testbook for medical students, it is also one of the authoritative texts on public health administration. All aspects of a modern public health program from the American viewpoint are covered in this book, with sections on vital statistics, environmental sanitation, communicable disease control, child hygiene, adult health protection and promotion, and public health administration.

In the new edition, the space alloted to sections and emphasis given reflects the changing concepts of public health in the United States. Less space is devoted to sanitation and communicable disease control. More space is devoted to the health problems of adult life and to dis-

cussions of community responsibility and planning to meet these problems. The role of the practicing physician with respect to adult health protection and promotion is emphasized as well as the limitations of community action in this field. Considering the audience for which the book is intended, it seems that illustrations of approved wells, spring water boxes, and privies might be deleted without loss to the medical student.

A few entirely new sections which deal with conservation of vision, accident prevention, health programs for the young adult, and diseases of the liver have been added. Otherwise, the content and organization remain much as in the first edition, with deletions, additions, and revisions to bring the material up to date. The section on communicable disease control includes more data on therapy than before and the impact of the new antibiotics on control measures is discussed. Each section is followed by both cited and general references and frequently in the text the author suggests sources of additional information on the subject under discussion. Such references have been brought up to date and constitute a valuable feature.

The second edition is an improvement over the first and remains one of the invaluable general texts on public health, both for students in undergraduate medicine and for students in schools of public health.

—*Col. J. H. McNinch, MC, U. S. A.*

World Population Problems and Birth Control, by *C. G. Hartman, M. A. Breckenridge, R. C. Cook, C. B. Darner, M. E. Davis, H. F. Dorn, C. S. Ford, C. J. Gamble, J. S. Gillam, A. F. Guttmacher, G. W. Hunter, J. MacLeod, C. McLane, N. Millman, F. W. Notestein, W. T. Pommerenke, M. S. Rothnem, A. Stone, W. B. Stromme,* and *W. S. Thompson.* Originally published in Annals of the New York Academy of Sciences, Volume 54, Article 5, pages 729-868. Illustrated. The New York Academy of Sciences, New York, N. Y., publisher, 1952. Price $3.

This collection of papers is the result of the Conference on Worlc Population Problems and Birth Control, held by the Section of Biology of the New York Academy of Sciences, 19 and 20 October 1951. It can be divided into 2 sections. The first is the discussion of the problem of the increasing world population brought about by the steadily decreasing death rate combined with a continued high birth rate. In areas such as India, China, and Ceylon, where recent active public health measures have been instituted, there has been an alarmingly rapid increase in population with resulting insufficient housing and food. The remaining papers deal with the only humane solution offered to this problem—decreasing the birth rate. The recent experimental and physiologic work with relation to both fertility and sterility is reviewed. Recent work in the field of contraceptives, with emphasis on the use of a gel alone, seems promising.

—*Lt. Col. A. P. King, MC, U. S. A.*

Tetanus Treated With Cortisone

Labe C. Scheinberg, *Captain, U. S. A. F. (MC)* (1)

CASES of tetanus are rare in the Armed Forces because active immunization is so effective. Clinical descriptions of tetanus among civilians are numerous but those complicated by anaphylactic shock are less common. Anaphylaxis has been studied in laboratory animals and certain basic principles are well known. In 1906-1907 Rosenau and Anderson showed that injection of the sensitizing agent was followed by a latent period of from 10 to 12 days before the hypersensitive or anaphylactic state was established. It persisted for an indefinite period of several months. Intravenous shock-inducing injections gave the most constant reaction. The symptoms and lesions were found to be specific for a given animal species, irrespective of the nature of the sensitizing antigen (2).

Serum sickness, which is usually seen from 6 to 10 days after the initial injection of foreign serum, is characterized by swelling of the lymph nodes, urticarial or erythematous eruption with itching, edema of the face, eyelids, and ankles, pains in the joints, and fever. It is self-limiting and death rarely results. It is distinctly different in manifestations from the acute systemic reaction of anaphylactic shock with its fall of blood pressure, tachycardia, dyspnea of the asthmatic type, suffusion of the face, urticarial wheals, marked edema of the body, and collapse. Death may occur in a few minutes.

Cortisone has been used extensively in the treatment of many allergic diseases. It has been given prophylactically to prevent serum reactions or, at least, to attenuate the effect of the hypersensitivity. In the case reported it was used to combat a severe serum reaction (anaphylactic shock). A second reason for the use of cortisone in the treatment of tetanus would be to replace adrenocortical hormones exhausted in the course of the disease, and thus to aid the patient's

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(1) U. S. Air Force Hospital, Barksdale Air Force Base, La.

(2) Topley, W. W. C., and Wilson, G. S.: Topley and Wilson's Principles of Bacteriology and Immunity. 3d edition, revised by G. S. Wilson and A. A. Miles. Williams & Wilkins Co., Baltimore, Md., 1946. pp. 1136-1168.

recovery (3). Cortisone has been reported to produce mental changes in patients, but here there is the question of whether the anaphylactic shock, with its period of cerebral hypoxia, could not have produced the same findings.

CASE REPORT

A 24-year-old WAF officer was admitted to this hospital on 10 August 1951 complaining of difficulty in opening her mouth. This had been present for several hours before she came into the hospital. In addition she complained of generalized headaches and "nervousness." She had incurred a puncture wound from a rusty nail in her right heel on 1 August and received an injection of tetanus antitoxin the next morning. Two days later she suddenly developed dyspnea, aphonia, and giant urticaria. She stated that she took some "yellow pills" and soon felt better.

The physical examination was negative except for moderate nuchal rigidity, trismus, a small area of urticaria on her left shoulder, and a small recent puncture wound on her right heel. She was given 1 cc. of tetanus toxoid and 0.5 gram of sodium amytal intramuscularly on admission and 100 mg. of benadryl by mouth every 4 hours. It was decided to desensitize her to tetanus antitoxin in horse serum as bovine antitoxin was not available. At 9:00 p. m. on the day of admission she was given 0.1 cc. of a 1:100 dilution of tetanus antitoxin in horse serum intradermally. She was given progressively increasing doses every half hour. At 8:15 a. m. the next day, immediately following a dose of 2 cc. of undiluted tetanus antitoxin, she had a generalized convulsion with peripheral circulatory collapse, loss of consciousness, and stertorous respirations. She was deeply cyanotic and her peripheral pulse could not be felt. She was given 1 cc. of epinephrine and 0.5 gram of sodium amytal intravenously and oxygen by inhalation. Her blood pressure at this time was 50/0, and plasma was given intravenously. Three hours later her color was good and though she was still comatose her blood pressure had risen to 86/62. Cortisone in doses of 100 mg. was given intramuscularly at 4:00 p. m. and repeated every 4 hours. The patient had moderate facial edema at that time. Her blood pressure averaged 90/50 until the following day when it was normal. Her fluid intake and output during this period was adequate and she was maintained on parenteral fluids. On 12 August she responded to vocal stimuli. She was alert on 13 August, but began to have illusions and occasional visual hallucinations which persisted for 1 day. Cortisone therapy was discontinued at this time after a total dose of 750 mg. On 14 August she was more responsive and oriented, but paranoid and hostile at times. She continued to improve, both physically and mentally, and on 21 August complained

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(3) Christensen, N. A.; Keith, H. M.; Smith, L. A.; Hanson, N. O.; and Ralston, D. E.: Cortisone in treatment of tetanus; report of case. Proc. Staff. Meet., Mayo Clin. 27: 28-32, Jan. 16, 1952.

only of being "cloudy" in her ability to think and remember. Simple retention tests revealed some impairment of memory. Her judgment also appeared to be impaired at this time. A Hunt-Minnesota organic brain damage test revealed borderline brain damage as tested by general vocabulary, the digit repetition test, and visual motor co-ordination. The patient was given a 14-day convalescent leave on 22 August and returned to the hospital without any physical or mental residuals. A Wechsler-Bellevue intelligence scale was administered at this time and showed average intelligence and no evidence of organic brain damage.

The patient was seen last on 21 January 1952. She had been capably performing her duties since she had been discharged from a patient status and complained only of occasional, generalized headaches. Physical examination at this time revealed no abnormalities. A Rorschach test indicated no organic brain damage but suggested a paucity of inner fantasy life, maladjustment in interpersonal relationships, stereotypy and rigidity of thinking with narrow interest range, and weakness of affective adaptation. In reviewing the background of the patient, this agreed with her clinical findings and was present as a lifelong pattern of a schizoid personality.

DISCUSSION

With the advent of antibiotics and chemotherapy there have been fewer reports of serum sickness and anaphylactic shock. It is still a formidable problem in the therapy of tetanus with antitoxin in horse serum. Much has been written on the subject of anaphylaxis and serum sickness *(4, 5)*. Cortisone and ACTH are new drugs with which to attempt the prevention and treatment of serum reactions, and Selye's general adaptation syndrome has thrown new light on the possible mechanisms involved in the use of these hormones in anaphylaxis and other illnesses.

Among personnel in the Armed Forces tetanus is a relatively uncommon disease because of routine inoculation of troops with fluid tetanus toxoid. During World War II 30 cases of tetanus were reported in immunized allied personnel of which 22 were in the Royal Army. The British had been using only 2 inoculations in the basic immunization schedule prior to 1941. Three of the 8 patients with this disease in the U. S. Armed Forces died. Four cases were reported in the U. S. Army from 1941 to 1943 in personnel who had not been immunized *(6)*.

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(4) Kojis, F. G.: Serum sickness and anaphylaxis; analysis of cases of 6,211 patients treated with horse serum for various infections. Am. J. Dis. Child. 64: 93-143, July; 313-350, Aug. 1942.

(5) Dragstedt, C. A.: Anaphylaxis. Physiol. Rev. 21: 563-587, Oct. 1941.

(6) Miller, J. J., Jr.; Ryan, M. L.; and Beard, R. R.: Speed of secondary immune response to tetanus toxoid with a review of war reports and observations on simultaneous injection of toxoid and antitoxin. Pediatrics 3: 64-74, Jan. 1949.

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Reactions to tetanus antitoxin and toxoid manifested by edema of the glottis, dyspnea, and urticaria have occurred soon after the initial (in this case the sensitizing) dose of antitoxin or toxoid (7). This type of reaction was observed in this patient 2 days after the injection of tetanus antitoxin and 8 days prior to her admission to the hospital. During the desensitization with tetanus antitoxin she developed a fairly typical anaphylactic reaction which was treated symptomatically and with cortisone. On a hypothetical basis the cortisone therapy might be beneficial because: (1) it would replenish a theoretically depleted adrenocortical hormone level and so help the patient recover symptomatically while the tetanus ran its natural course; and (2) it would alleviate the allergic or anaphylactic manifestations resulting from horse serum hypersensitivity, or perhaps prevent their occurrence (3).

Experimentally the treatment of anaphylaxis with cortisone and ACTH has shown both promising and poor results. Neither cortisone nor ACTH forestalled the histamine effects in intestinal strips of guinea pigs in vitro nor prevented death from 1 lethal dose of histamine. These hormones did not prevent anaphylactic reactions in vivo or in vitro in actively and passively sensitized guinea pigs and they did not decrease the mortality in guinea pigs from anaphylactic shock (8). When rabbits were treated with horse serum in a manner known to favor the development of periarteritis nodosa, cardiac inflammatory lesions, and acute glomerulonephritis, those treated with cortisone developed fewer cardiovascular lesions, and had glomerular proliferation suppressed to a significant extent, when compared to the unprotected control group (9).

Clinically, treatment of allergic conditions with cortisone and ACTH has shown favorable results. Patients with drug sensitivity to penicillin, chloramphenicol, and other drugs have shown a good response to cortisone and ACTH therapy, but there were relapses following cessation of therapy (10, 11). Similarly bronchial asthma responds well

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(7) Long, A. P.: Tetanus toxoid, its use in United States Army. Am. J. Pub. Health 33: 53-57, Jan. 1943.

(8) Landau, S. W.; Nelson, W. A.; and Gay, L. N.: Effect of adrenocorticotropic hormone (ACTH) and cortisone on histamine reactions and anaphylactic reactions in guinea pigs. Bull. Johns Hopkins Hosp. 88: 395-401, May 1951.

(9) Rich, A. R.; Berthrong, M.; and Bennett, I. L.: Effect of cortisone upon experimental cardiovascular and renal lesions produced by anaphylactic hypersensitivity. Bull. Johns Hopkins Hosp. 87: 549-568, Dec. 1950.

(10) Carey, R. A.; Harvey, A. M.; Howard, J. E.; and Wagley, P. F.: Effect of adrenocorticotropic hormone (ACTH) and cortisone on drug hypersensitivity reactions. Bull. Johns Hopkins Hosp. 87: 354-386, Nov. 1950.

(11) Feinberg, S. M.; Dannenberg, T. B.; and Malkiel, S.: ACTH and cortisone in allergic manifestations; therapeutic results and studies on immunological and tissue reactivity. J. Allergy 22: 195-210, May 1951.

to hormone therapy but tends to relapse after its discontinuance (12). There are indications enough to warrant the administration of these hormones to patients undergoing serum therapy.

The occurrence of psychiatric manifestations or psychotic episodes in any large series of patients being treated with cortisone or ACTH for other chronic illnesses is common. Usually there is increased nervousness, depression, insomnia, or euphoria; pathologic excitement and frank schizophrenic psychosis have also been reported (13-16). In the case presented there was the relatively unusual "grade 4 response" as described by Rome and Braceland (17), and a brief schizophrenic episode as determined by the patient's prepsychotic personality. There was a return to her former level of psychologic adaptation on withdrawal of the drug. This prepsychotic personality was confirmed by psychologic testing after her recovery.

SUMMARY

A case of tetanus occurred in a patient who had been sensitized 10 days prior to admission with an injection of tetanus antitoxin. She had an early serum reaction and, following admission, exhibited an anaphylactic reaction while being desensitized with horse serum. During symptomatic treatment with cortisone, there was a brief psychotic episode which disappeared after discontinuing the drug. Psychologic testing following recovery indicated a schizoid personality.

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(12) Friedlaender, S., and Friedlaender, A. S.: Effect of cortisone administered orally in bronchial asthma. J. A. M. A. 146: 1381-1382, Aug. 11, 1951.

(13) Freyberg, R. H.; Traeger, C. H.; Patterson, M.; Squires, W.; Adams, C. H.; and Stevenson, C.: Problems of prolonged cortisone treatment for rheumatoid arthritis; further investigations. J. A. M. A. 147: 1538-1543, Dec. 15, 1951.

(14) Irons, E. N.; Ayer, J. P.; Brown, R. G.; and Armstrong, S. H.: ACTH and cortisone in diffuse collagen disease and chronic dermatoses; differential therapeutic effects. J. A. M. A. 145: 861-869, Mar. 24, 1951.

(15) Hoefer, P. F. A., and Glaser, G. H.: Effects of pituitary adrenocorticotropic hormone (ACTH) therapy; electroencephalographic and neuropsychiatric changes in 15 patients. J. A. M. A. 143: 620-624, June 17, 1950.

(16) Baehr, G., and Soffer, L. J.: Treatment of disseminated lupus erythematosus with cortisone and adrenocorticotropin. Bull. New York Acad. Med. 26: 229-234, Apr. 1950.

(17) Rome, H. P., and Braceland, F. J.: Use of cortisone and ACTH in certain diseases; psychiatric aspects. Proc. Staff. Meet., Mayo Clin. 25: 495-497, Aug. 16, 1950.

BOOK REVIEW

Congenital Dysplasia of the Hip Joint and Sequelae (In the Newborn and Early Postnatal Life), by *Vernon L. Hart,* M. D., F. A. C. S., Assistant Professor of Surgery, University of Minnesota, Minneapolis, Minn. Detroit Orthopedic Lecture, Auspices of the Wayne County Medical Society, Detroit, Mich., 6 December 1948. American Lecture Series Publication Number 102, A Monograph in American Lectures in Surgery. 187 pages; illustrated. Charles C Thomas, Publisher, Springfield. Ill., 1952.

Over one-half of this book is devoted to illustrative photographs and roentgenograms of excellent quality with ample footnotes. An extensive historical background of congenital hip dysplasia is given, followed by a discussion of the cause, pathogenesis, clinical findings, Ortolani's "jerk of entry" and "jerk of exit," rotational attitude of the extremities, pathologic dislocation, roentgenographic features, differential diagnosis, and treatment. Hilgenreiner's method of measuring the degree of dysplasia and displacement of the infant hip joint before the roentgenographic appearance of the center of ossification of the femoral head is presented in detail.

The author stresses the fact that hip joint dysplasia is common in early infancy, not because congenital dislocation of the hip is common but because congenital subluxation of the hip is a common cause of disability soon after early adult life. He says, "Treatment of congenital subluxation or predislocation of the hip during early infancy before the function of weight bearing begins is the secret for improving our results of treatment of congenital dislocation of the hip." Weight bearing begins with creeping, usually in the seventh month of life. Treatment at this time prevents dislocation and other serious secondary changes of all hip joint structures. The use of the Frejka abduction pillow splint is recommended and instructions for making and maintaining the splint are given. The author believes that the proper application of this splint for dysplasia in early infancy, after concentric reduction, will eliminate hospitalization, traction, manipulation, trauma, plaster immobilization and passive abduction frames, and provide active and functional immobilization. He concedes that complete dislocation of the femoral head from the acetabulum should not be treated with the Frejka splint except in cases which are recognized and easily reduced by Ortolani's maneuver in the first several days or weeks of life.

The author states that congenital dysplasia of the hip in early infancy is primarily a problem for the general practitioners and the pediatricians, but he concludes with a plea for a co-ordination of efforts of the above with roentgenologists and orthopedists.

—*Col. G. G. McShatko, MC, U. S. A.*

Adaptation to Stryker Frame

Roy Weir, Jr., *Lieutenant Colonel, MSC, U. S. A.* (1)

TIDAL drainage has proved to be an asset in the treatment of paraplegic patients, but because these patients frequently must be transported to clinics and physiotherapy and x-ray departments the drainage must be interrupted, causing distress to the patients. The equipment in use for the tidal drainage was awkward and caused the ward to appear untidy. An irrigator stand was required beside each Stryker frame to hold the irrigating jar while a drainage bottle was needed on the floor for each patient. In order to police the area these pieces of equipment had to be picked up, and in caring for these patients, the drainage jars were often kicked over, causing unnecessary work.

To solve this problem, a member of the management office of this hospital suggested the construction of an economical and workable adaptation which is shown in figure 1.

The items used and the cost of each are shown in table 1.

The hook (fig. 1P) required to hold the irrigating jar was attached to the steel rod (fig. 1A) with a machine screw. The steel rod was bent to the desired angle. The galvanized cap (fig. 1B) was drilled to receive the rod, and the cap was screwed onto the pipe (fig. 1D). The wing nut (fig. 1C) was inserted into the pipe (fig. 1D) by drilling. The pipe was screwed into the T-pipe (fig. 1E) which was slipped with ease over the top Stryker frame support. The T-pipe was drilled to receive the hexagonal head bolt. The cold rolled steel rod (fig. 1G) was welded to the cold rolled steel strap (fig. 1I, J, K, L, M) which is one piece. This with the circular band (fig. 1N) formed a holder for the drainage bottle. The lower vertical segment (fig. 1I) is 14½ inches long; the horizontal segment (fig. 1K) is 4 inches long; the segment across the bottom of the holder (fig. 1L) is 5 3/8 inches long; and the upright segment of the holder (fig. 1M) is 5 inches long. The upright segments (fig. 1M and I) are welded to the circular band (fig. 1N) which is 5 3/8 inches in diameter. This assembly was mounted on the Stryker frame with 2 flat-head screws. This adaptation to the Stryker

(1) Valley Forge Army Hospital, Phoenixville, Pa.

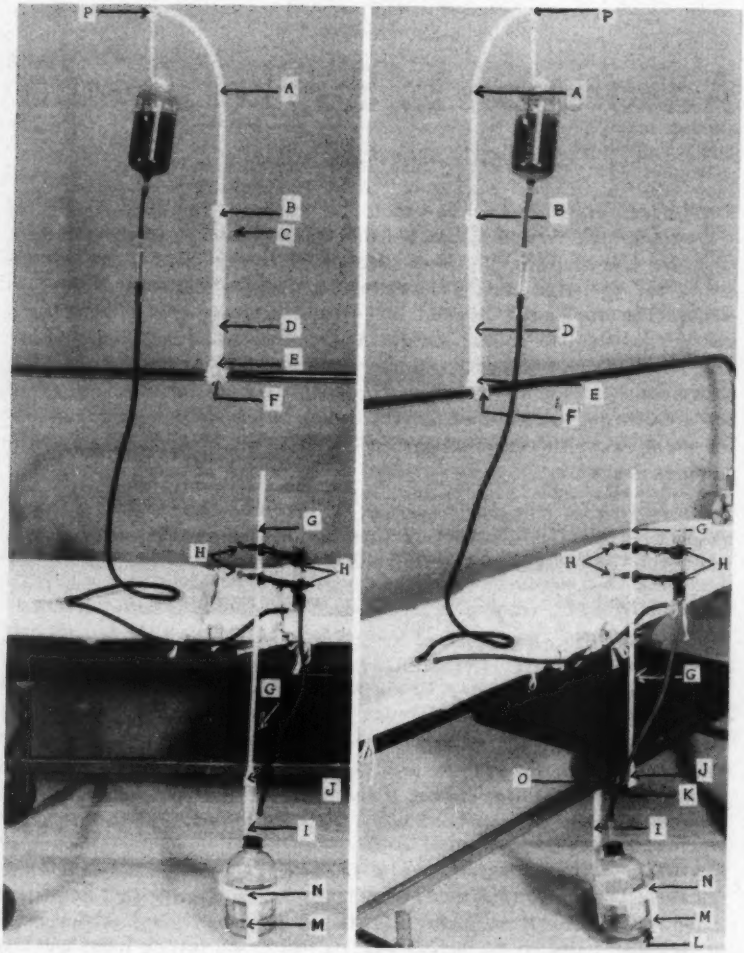


Figure 1.

frame is light in weight and easily operated. It does not interfere with the activities of the patient or the ward personnel. The patient can be turned without adjusting the equipment.

TABLE 1.

Item	Cost
½-inch steel rod, 36 inches long (fig. 1A)	$ .50
3/4-inch galvanized cap (fig. 1B)	.20
1/4-20 wing nut (½-inch long) (fig. 1C)*	.05
3/4-inch galvanized pipe, 14 inches long, threaded (fig. 1D)	.70
1- by 1- by 3/4-inch T-pipe copper tubing, threaded on lower 3/4 inch (fig. 1E)	.90
3/8-16 hexagonal head bolt (1½ inches long) (fig. 1F)**	.05
3/8- by 27-inch cold rolled steel rod (fig. 1G)	.35
2 clamps, burette, single (Medical Supply Catalog Item 4-175-000) (fig. 1H)***	
1/8 by 1 by 48 inch cold rolled steel strap (fig. 1I)	.55
Cost of parts	$3.30
Two hours' labor at $1.65 per hour	3.30
Total cost	$6.60

*1/4 inch in diameter and has 20 threads per inch.
**3/8 inch in diameter and has 16 threads per inch.
***Standard Item of Issue, not included in cost.

Because of its simplicity of operation, economy, and portability this adaptation should prove useful in any hospital caring for paraplegic patients.

BOOK REVIEW

The Scalp in Health and Disease, by *Howard T. Behrman,* A. B., M. D., Assistant Clinical Professor of Dermatology, New York University Post-Graduate Medical School; Adjunct Dermatologist, Mount Sinai Hospital; Attending Dermatologist, Hillside Psychiatric Institute, Formerly Associate Dermatologist, Bellevue Hospital, and Assistant Attending Dermatologist, University Hospital; Fellow in Dermatology, New York Academy of Medicine; Member, Committee on Cosmetics, American Medical Association; Society of Cosmetic Chemists; Society for Investigative Dermatology; Fellow, American Academy of Dermatology; Diplomate, American Board of Dermatology. 566 pages; 312 illustrations. The C. V. Mosby Co., St. Louis, Mo., publisher, 1952. Price $12.50.

The first chapter of this encyclopedic textbook includes a study of all known functions and activities of the normal scalp and appendages including embryology, anatomy, hair patterns, anthropology, endocrinology, and physiology. The second chapter stresses the care of the normal scalp and discusses the use and action of hair dyes, hair straighteners, and hair wave materials. In addition, the author gives a concise dissertation on the cause and diagnosis of dermatitis resulting from the use of certain preparations on the scalp. Subsequent chapters pertain to all known disorders of the scalp grouped on an etiologic basis. This section includes alopecia, seborrheic diathesis, infections, psychogenic disorders, scalp involvement from other skin diseases, scalp disorders due to systemic diseases, and new growths. Each disease entity is discussed under clinical features, pathology, etiology, and therapy. Voluminous references which have been used by the author are listed at the conclusion of each chapter. The book is well illustrated with photographs which the author has secured from world-wide sources. A formulary containing shampoos, scalp lotions, and ointments of various types and other medications as indicated for the treatment of the diseased scalp is included. The author has furnished the reader a complete compilation of knowledge pertaining to his subject and has presented it in a concise and practical fashion, stressing the basic anatomic and physiologic approach. This textbook should prove valuable not only for the dermatologist and those interested in the normal and diseased scalp but for every medical library.—*Lt. Col. W. N. Piper, MC, U. S. A.*

Average Hospital Stay for Disability Cases Lowered in 1951[1]

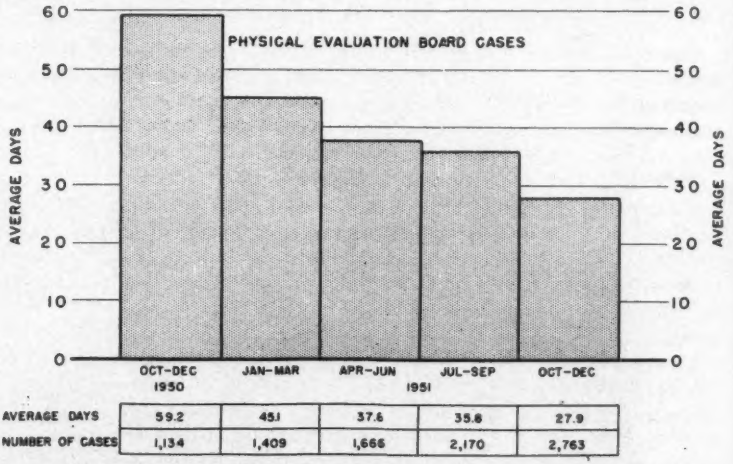
THE Surgeon General of the Army reports that considerable success has been achieved in reducing the amount of time spent in Army hospitals by patients who are being processed for separation because of physical disability. In the last 3 months of 1951 the average number of days such patients spent in hospitals subsequent to the decision that they should be seen by a physical evaluation board was less than half as great as it had been a year earlier. The reduction has resulted from a series of changes in administrative procedures, including arrangements whereby many such patients are physically transferred to their homes well ahead of the date when all of the required review of the case has been completed and they can be completely dropped from the hospitals' rolls.

The enactment of the Career Compensation Act of 1949 produced a number of changes in the disability separation procedure, some of which had potentially troublesome implications insofar as provision of hospitalization in the Army was concerned. Before that time an enlisted person was separated for disability under a relatively simple and direct procedure administered by the local command when it was medically determined that he was physically or mentally unable to continue to perform military service. No specific determination of the percent of compensable disability had to be made by the Army hospital treating him because the question of disability claim against the government in such cases was the responsibility of the Veterans Administration and that agency in any event made a careful independent evaluation of the compensable extent of physical disability. Under the new law, however, the military services have responsibilities in connection with the pay and medical care of persons retired for physical disability and specifically have responsibility for determining the exact nature and percent of disability for all patients retired for disability and for many other patients otherwise separated for disability. Moreover, the administrative processing ordinarily required

(1) From the Statistical Division, Office of the Surgeon General, U. S. Army.

to separate an Army patient for disability under the new law involves (1) screening by a medical board, (2) approval by the hospital commander of medical board findings, (3) a physical evaluation board hearing, and (4) review and final action by the Department of the Army. It was recognized immediately that this increased administrative processing time would tend to prolong the hospital stay of permanently disabled patients. This presented a problem in view of the constant efforts to conserve the time of scarce medical and nursing personnel and to operate with the greatest possible economy while still having available the necessary hospital facilities to provide medical care to Army personnel. Accordingly, the Surgeon General instituted a series of changes in administrative procedures designed to keep to the minimum the number of hospital beds occupied by permanently disabled patients and the medical personnel required for their care insofar as this is consonant with providing appropriate hospitalization.

Among the principal features of the revised administrative processing are provisions for getting permanently disabled patients out of the hospital as soon as the physical evaluation board has completed its evaluation of the patient's condition. This is done by transferring the patient to his own home, in most cases, and still carrying him on the rolls of the hospital but not as a patient occupying a bed. If the patient requires continuous hospitalization, early transfer to a Veterans Administration hospital is made possible by a procedure



	OCT-DEC 1950	JAN-MAR	APR-JUN	JUL-SEP	OCT-DEC 1951
AVERAGE DAYS	59.2	45.1	37.6	35.8	27.9
NUMBER OF CASES	1,134	1,409	1,666	2,170	2,763

Figure 1. Average hospital-bed days after medical board approval. (Average number of hospital-bed days from date of approval of medical board recommendation for referral of patient to a physical evaluation board to the date of retirement or separation for disability. Excludes days lost on detached service, in quarters, on leave, or AWOL. Data from United States hospitals only.)

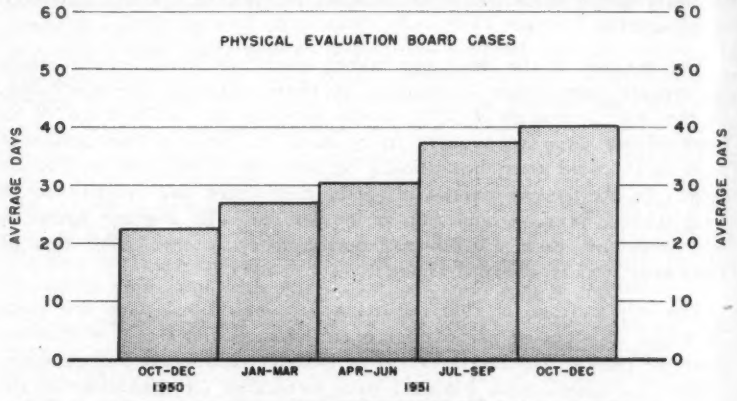
whereby he is regarded as being in "detached service" at the Veterans Administration hospital and so not occupying a bed in the Army hospital, although still carried on its rolls for administrative purposes (military pay, completion of records, et cetera), until the actual day of separation.

The results of the measures taken, when one looks at the effect on average days spent in hospital by these patients, are gratifying. In the last 3 months of 1950, these patients had an average of 59 hospital-bed days subsequent to approval of the recommendation of a medical board that they should be seen by a physical evaluation board; in the last 3 months of 1951, this figure had dropped to 28 hospital-bed days, a reduction of 47 percent. The average hospital-bed days for each quarter-year period from October 1950 through December 1951 is shown in figure 1.

The implications of this reduction in hospital-bed days are great in terms of economy of hospital operations, maximal use of existing hospital plants, and conservation of medical personnel. For example, almost 1.5 times more patients were separated for disability in the last quarter of 1951 than were so separated in the same period of 1950. If the 2,763 patients separated for disability in the last quarter of 1951 had spent the same average number of hospital-bed days (59.2) in the hospital after medical board approval as in the last quarter of 1950, the total hospital-bed days required by such patients would have been 163,570—more than double the number actually required (77,088 hospital-bed days). This amounts to a saving of 86,482 hospital-bed days in the last quarter of 1951, or a daily average of 960 beds occupied. This patient load, had it materialized, would have required the operation of an additional 1,200-bed hospital with its accompanying costs in personnel and funds.

It can be demonstrated that the reduction in the average hospitalization of these patients results in large part from the measures described above. Figure 2 shows the average number of days spent on detached service by these patients, retired or otherwise discharged, during each quarter of the period from October 1950 through 1951. This chart shows a pattern the reverse of that shown for the average duration (fig. 1). In the last quarter of 1950 an average of 22 days was spent on detached service, but by the last quarter of 1951 this had risen to 40 days. This difference of 18 days accounts for a large part of the 31 days' reduction in the average days of bed occupancy discussed above. An additional portion of the saving resulted from the early transfer to VA hospitals of patients requiring continued hospitalization. There are many other actions involved in the program of the Surgeon General to reduce the time of bed occupancy, including emphasis on early determination of eligibility for physical evaluation board consideration, expeditious procuring of necessary past medical records, and the like, but the two measures discussed above have

produced most of the reduction. The program of improving disposition of patients and eliminating all unnecessary hospital-bed days has not been limited to patients separated for disability but has likewise



	OCT-DEC 1950	JAN-MAR	APR-JUN	JUL-SEP	OCT-DEC 1951
AVERAGE DAYS	22.4	26.8	30.3	37.3	40.1
NUMBER OF CASES	1,134	1,409	1,666	2,170	2,763

Figure 2. Average days on detached service after medical board approval. (Average number of days on detached service from date of approval of medical board recommendation for referral of patient to a physical evaluation board to the date of retirement or separation for disability. Data from United States hospitals only.)

been directed at all other categories of patients. It has included steps aimed at effecting early disposition of such patients and, in many instances, getting the patient out of the hospital bed even before actual disposition when administrative processing time would otherwise prolong the period spent occupying a hospital bed.

BOOK REVIEWS

Essentials in Diseases of the Chest for Students and Practitioners, by *Philip Ellman,* M. D., F. R. C. P., Consultant Physician in Diseases of the Chest to the North-East Metropolitan Regional Hospital Board at East Ham Chest Clinic, Harts Sanatorium and Plaistow Hospital Chest Unit, London; Consultant Physician St. Stephen's Hospital (Rheumatism Unit), London and Dorking General and Leatherhead Hospitals; Lately Physician in Charge Medical Division, Leatherhead Emergency Hospital of King's College Hospital; Editor British Journal of Tuberculosis and Diseases of the Chest, With a Foreword by Sir *Robert A. Young,* C. B. E., M. D., F. R. C. P., Hon. Consultant Physician to the Middlesex Hospital and to the Brompton Hospital; Consulting Physician to King Edward VII Sanatorium, Midhurst; Vice-Chairman of the Council of the National Association for the Prevention of Tuberculosis. 400 pages; illustrated. Geoffrey Cumberlege, Oxford University Press, New York, N. Y., publisher, 1952.

Because the author of this small book attempts to simplify the approach to diseases of the chest, it will be of great value to students and practitioners. The initial chapters contain an easily understood review of basic respiratory physiology and serve to orient the reader as to the general relationship of chest diseases to general medicine. The various diseases of the lungs are dealt with from etiologic, diagnostic, and therapeutic standpoints. Although concise, the handling of each entity is thorough. The final chapters deal with the lungs in circulatory and allied diseases with observations on chest diseases in childhood and old age. This book is a source of quick information for the handling of the immediate problem in a specific patient with chest disease. The chest specialist will find the work oversimplified.

—*Commander J. B. MacGregor, MC, U. S. N.*

Lung Abscess, by *R. C. Brock,* M. S., F. R. C. S., F. A. C. S. Thoracic Surgeon to Guy's Hospital, Surgeon to the Brompton Hospital; Formerly Consulting Thoracic Surgeon to the London County Council. 197 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1952. Price $7.75.

This monograph is based on a series of essays by the author which appeared in Guy's Hospital Reports between 1945 and 1948. The statistical analyses in the monograph are based on a series of 477 patients suffering from lung abscesses. The subjects covered in the monograph include (1) broncho-pulmonary segmental anatomy, (2) the pathology of lung abscess, (3) anaerobic (fetid) lung abscess, (4) aerobic (nonfetid) lung abscess, (5) staphylococcal lung abscess, (6)

Friedländer lung abscess, (7) the etiology of lung abscess, (8) lung abscess and bronchial carcinoma, and (9) the treatment of lung abscess. The British style of writing makes for pleasant and easy reading. It is well printed on good paper and has 60 illustrations including line drawings and roentgenograms. The illustrative roentgenograms suffer in that they are positive plates, no doubt to avoid the expense of the double process. They do, however, demonstrate the points which the author wishes to stress. The author makes a strong and well-founded plea for the use of lateral as well as posteroanterior roentgenograms of the chest and for exact anatomic localization and anatomic study of the lesion as the first step in the diagnosis and as the basis for proper therapy of lung abscess. This valuable monograph is highly recommended for those interested in diseases of the chest.

—*Commander T. D. Cuttle, MC, U. S. N.*

Biochemistry for Medical Students, by *William Veale Thorpe,* M. A. (Cantab.), Ph. D. (Lond.), Reader in Chemical Physiology, University of Birmingham. 5th edition. 528 pages; 41 illustrations. J. B. Lippincott Co., Philadelphia, Pa., publisher, 1952.

This volume constitutes a remarkable compendium of knowledge in biochemistry in that it avoids becoming a sheer catalog of facts despite the enormous amount of material covered in a mere 500 pages. The clarity of language and the liberal use of briefly stated interpretative generalizations in clinical chemistry are responsible for this quality. Designed for the use of medical students, it can be recommended to the clinical chemist and particularly to the physician for use as an initial reference source and for review purposes in biochemistry. Consistent with its objective, its main emphasis is on amply tested phenomena and relationships. The judicious use of formulas will appeal to those who, although they are not principally students of organic chemistry, are nevertheless sensitive to the need for a recognition and an understanding of the universal language of characteristic chemical groups.

Chapters 2, 3, and 4 are notable for the ease with which they impart a capacity for the functional use of cardinal principles of physical chemistry pertinent to biologic systems. The chapters on nutrition include a clear exposition of the nature and the significance of the Krebs tricarboxylic acid cycle. Many will welcome the brief but highly informative discussion of the role of isotopes in biochemical research. Thorpe's chapter on the metabolism of foreign organic compounds constitutes a high accomplishment in the organization of fundamental knowledge in toxicology. Nutritional requirements and the composition of foods, receive comprehensive treatment. In conclusion, I wish that my own introduction to biochemistry had been through such a text.

—*Lt. Col. T. J. Domanski, U. S. A. F. (MSC)*

Heart Disease, by *Paul Dudley White,* M. D., Executive Director, National Advisory Heart Council; Consultant to the Massachusetts General Hospital, Boston; Recently Clinical Professor of Medicine, Harvard Medical School. 4th edition. The Macmillan Co., New York, N. Y., publisher, 1951. Price $12.

The latest edition of this classic textbook of cardiology comes out at a time when investigative data and clinical material in this sphere have accumulated at an unprecedented rate. Since the third edition, procedures which were experimental have become routine diagnostic aids and therapeutic measures. It is to the author's credit then that he has, in one volume, covered not only the basic material in cardiology but also discussed the newer knowledge. That the author is particularly aware of this change is indicated by his new first chapter entitled, "The Evolution of our Knowledge of the Heart and its Diseases."

The student who wishes detailed knowledge in such subjects as cardiac catheterization, angiocardiography, electrocardiography, ballistocardiography, electrokymography and other procedures must still consult the original references or the specific monographs, but this does not detract from the value of this book. In fact, more than ever, a single volume which correlates all parts of the subject is needed. Readers familiar with the earlier editions will be aware of many changes in the present volume. In some chapters the presentation is essentially unchanged except for the discussion of newer drugs or statistical material and in others the revision is more radical.

This is probably the best single volume in this specialty and is highly recommended for the physician wishing only one reference, but is also recommended as a point of departure for the person starting an intensive study of the field of heart disease. This edition is slightly larger in size than the previous one. Although the printing is much improved, there is less improvement in the illustrations.

—*Commander R. C. Parker, Jr., MC, U. S. N.*

Accelerated Conduction, The Wolff-Parkinson-White Syndrome and Related Conditions, by *Myron Prinzmetal,* M. D., *Rexford Kennamer,* M. D., *Eliot Corday,* M. D., *John A. Osborne,* M. D., *Joshua Fields,* M. D., *L. Allen Smith,* M. D. Modern Medical Monographs Number 3. 110 pages; illustrated. Grune & Stratton, Inc., New York, N. Y., publisher, 1952. Price $4.

This monograph gives an unusually interesting description of a condition seen frequently by practitioners of internal medicine as well as by cardiologists. Dr. Prinzmetal is well known for his cinematographic recordings of normal and abnormal hearts. This book gives convincing experimental evidence coupled with some pathologic studies of human subjects to show that the "accelerated conduction theory" explains the Wolff-Parkinson-White types of arrhythmia better than the long-accepted

theory of an abnormal or accessory bundle of neuromuscular fibers. The authors stress that this acceleration in conduction of the impulse from the S-A node to the ventricles takes place in the A-V node. This conception is supported by 8 experiments connected with mechanical stimulation of ventricles, chemical stimulation, direct electrical current stimulation, and other modifications. This theory explains the many variations in the Wolff-Parkinson-White syndrome and especially its occurrence in older patients in whom it is probably not congenital. In performing the studies, the authors used a fast camera and a high-speed run of electrocardiographic paper in order to record the changes taking place in the experimental dog's heart photographically and electrocardiographically at the same time.

The main impetus for performing these special studies was brought on by rhythmic and other cardiac disturbances noticed by the authors in connection with thoracic surgery, particularly for bronchogenic carcinoma. Even though this book covers a very limited field it should inspire any student of medical science.

—*Col. U. R. Merikangas, MC, U. S. A.*

Useful Drugs, A Selected List of Essential Drugs With Brief Discussions of Their Actions, Uses and Dosage. Issued Under the Direction and Supervision of the *Council on Pharmacy and Chemistry of the American Medical Association.* 15th edition. 262 pages. J. B. Lippincott Co., Philadelphia, Pa., publisher, 1952. Price $3.

The new edition of this valuable compendium of the best from the *U. S. Pharmacopeia, The National Formulary,* and *New and Nonofficial Remedies* has appeared after an interval of 5 years. It remains, as former editions have been, an aid to the student bewildered by a myriad of therapeutic preparations old and new and to the busy practitioner as well. Those who are partial to preparations not listed here would do well to consider whether what they use be merely good rather than the best. About half of the members of the Council on Pharmacy and Chemistry responsible for compiling these volumes have been replaced since the publication of the 14th edition, but the Council is, as always, composed of outstanding men in this field. The type in the new edition is more attractive than that used in previous editions and the running heads at the top of the pages now name the drug discussed instead of the title of the book as formerly. Despite many deletions from the old volume, this book, like all books on scientific subjects these days, shows a gradual increase in size from one edition to the next.

There is not room here to mention all the items added in the last 5 years, but these include the antihistamine agents; such biologic products as influenza virus vaccine, Rocky Mountain spotted fever vaccine, blood grouping serums, and anti-Rh typing serums; such antibiotics as aureomycin, chloramphenicol and dihydrostreptomycin (but not terramycin); the antimalarial drugs, chloroquine and pentaquine (totaquine has been dropped); BAL; the new insect repellent, dimethylphthalate; fibrin foam;

heparin (but not dicumarol); lidocaine and piperocaine (benzocaine has been dropped); the analgesic, methadone; propylthiouracil in place of thiouracil; sulfoxone for leprosy (ethyl chaulmoograte has been dropped); sulfamethazine (sulfaguanidine, sulfanilamide, and sulfapyrazine have been dropped); and the vitamin preparations, calciferol and folic acid. Other preparations dropped from the new edition are such simple and therapeutically unimportant items as cardamom seed, cinnamon, clove, cresol, lard, lime, mustard, ox bile, rose water, senna, soap, and sulfur. Why phenolphthalein has been retained is something of a puzzle, but it is gratifying to note that chlorophyll, the new miracle drug, has found no place here.

An odd typographical blunder which was a little confusing at first glance was the fact that page 238 is continued from page 236 leaving page 237 blank. In the section on pharmaceutic preparations the large headings "Oils," "Salts," and "Tablets" are also a little confusing and might better have been omitted. The therapeutic index and general index are both excellent.

It was of some interest to compare this volume with the fourth edition (1920) which helped get me through medical school. Among the items which have been dropped in the intervening years are many which have been completely forgotten and many others which have undergone refinement of their therapeutic principles. The older volume included for example, acacia, aconite, aloe, alum, asafetida, belladonna, balsam of Peru, boric acid, camphor, cantharis, croton oil, chloroform, chrysarobin, cinchophen, cocaine, creosote, ergot, eucalyptus, gentian, ginger, guaiacol, hydrastis, ichthyol, iodoform, ipecac, jalap, lead acetate, licorice, linseed oil, mercury salicylate, naphthol, myrrh, nitric acid, nux vomica, opium, pancreatin, pepper, pepsin, phosphorus, pine tar, potassium permanganate, rhubarb, sugar, santonin, squill, sodium cacodylate, staphylococcus vaccine, stramonium, strychnine, tannic acid, turpentine, terpin hydrate, thymol, tragacanth, valerian, and water. Therapeutically we have indeed come a long way in 32 years.

Col. W. G. Brandstadt, MC, U. S. A.

Studies on Testis and Ovary Eggs and Sperm, Proceedings of a Conference, Sponsored by the *Committee on Human Reproduction, National Research Council*, in behalf of the National Committee on Maternal Health, Inc. Edited by *Earl T. Engle*. 237 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1952. Price $7.50.

This book is a report of an annual symposium dealing with the gonads and their gametes. Fourteen topics are considered. The first, by Nelson, is spermatogenesis in the testes of men with blocked or absent efferent ducts. Biopsy specimens prove that these men had patterns of testicular morphology which were no different from those seen in men with patent efferent ducts. Elftman describes the various cystochemical methods employed currently to reinterpret, on a chemical basis, such cytoplasmic details as chromosomal permutations and acrosome formation. Scott

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and Lynch discuss the newer concepts regarding the exact function of the Sertoli cell of the testis and the possibility of its estrogen-producing potentialities as indicated by the lipid content.

MacLeod presents an article on semen quality in fertile marriage. This is a gigantic piece of work by an outstanding authority, who concludes that the fertility of a person with a sperm count of less than 30,000,000 per cc., even though the sperms are actively motile, is questionable. This differs markedly from the standards of Farris. MacLeod also presents an article on new aspects of the relationship between the metabolism and motility of human sperms which indicates that the enzyme systems in the sperms containing sulfhydryl groupings play an important, if not vital, role in their motility. Written on a similar theme, Lardy discusses the metabolic regulator in mammalian sperms and concludes that epididymal sperms are metabolically more efficient than ejaculated sperms by reason of a substance liberated from them during storage in seminal fluid. Bishop contributes an article on the metabolic machinery of sperm activity, emphasizing the fact that the sperm should be recognized as a complete, if changing, organism.

European investigators are represented by Westman of Sweden ("Investigations into the Transport of the Ovum") and Courrier of France ("Allenolic Acid, a New Estrogen"). The remaining articles include "Genetically Determined Variations in Male Fertility in the House Mouse" by Dunn, "Semi-sterility in the Mouse caused by Radiation Induced Chromosome Changes" by Snell, "The Morphologic Basis of Ovarian Function" by Taylor, McAuley, and Engle, "Cytochemical Study of Lipids in the Ovaries of the Rat and Sow during the Estrous Cycle" by Dean and Barker, and "The Embryonic Nature of the Adult Ovary" by Mossman.

This volume of original contributions to an interesting and important division of medicine is of primary interest to the physiologist, geneticist, gynecologist, and urologist, all of whom are frequently beset by problems of sterility and decreased fertility.

—*Capt. S. Johnson, MC, U. S. N.*

Advances in Medicine and Surgery, From The Graduate School of Medicine of the University of Pennsylvania. Prepared by The Editorial Committee consisting of *Julius H. Comroe, Jr.,* M. D., Chairman; *David L. Drabkin,* M. D.; *Oscar V. Batson,* M. D.; and *Aims C. McGuinness,* M. D., Dean. 441 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1952.

This volume is an outgrowth of a desire by the faculty of the Graduate School of Medicine of the University of Pennsylvania to offer yearly a brief, integrated course which would provide a broad appraisal of current medical knowledge. The first such course was organized in 1950 by Dr. William S. Parker, then Dean. This book includes 10 symposiums on subjects selected because of recent advances and current interest in them by the practitioner.

The first symposium deals with the present status of adrenal cortical hormones. It covers the biochemical, physiologic, and pathologic aspects of their use. It is followed by a concise discussion of diseases caused by chronic adrenal cortical hyperfunction and pertinent general aspects of ACTH and cortisone therapy, and finally the use of both hormones in the treatment of rheumatic fever and renal disease. The second symposium discusses the role of potassium in health and disease. It opens with a scholarly presentation of technical and fundamental orientation on potassium, including the physiologic regulation of body fluids. An excellent section follows on the physiologic classification, diagnosis, and treatment of clinical disturbances, re-emphasizing scientific facts in the light of practical clinical applications. Concise presentations of great interest to the clinician are the sections on the metabolic (diabetes), cardiac, neuromuscular, and surgical (burns) aspects of potassium. The third symposium, on hypertension, presents pathologic basic concepts, the evaluation of the patient, and the use of new drugs, diet, and surgery in the treatment of patients with this condition. The next symposium, covering newer concepts in the preoperative evaluation and preparation of patients, is filled with many valuable clinical observations and offers many "rules of thumb" helpful in determining fluid, electroylte, vitamin, and caloric requirements for the patient. The chapter on thromboembolism has an especially valuable discussion of the diagnosis and the physiologic aspects of pulmonary embolism. The chapter on pulmonary infections includes a discussion of pathogenic fungi and important advances in the surgical treatment of pulmonary and pleural infections, including the use of streptokinase and streptodornase. Symposiums follow on the relief of pain, cancer, and recent developments in viral diseases. The section on viral hepatitis and Coxsackie viruses is especially stimulating and acquaints the reader with the pertinent problems confronting the research worker and the clinician. The final symposium is on functional disorders and discusses this important subject from its gastrointestinal, neurologic, cardiac, and dermatologic aspects.

This is an admirable review of the latest advances in medicine presented in such a way as to help the clinician to know the fundamental "why and how." The more difficult scientific fundamentals are driven home by forceful repetition of salient facts with their clinical applications. The physician who will not only read but study this volume, will add much to his store of scientific and clinical knowledge.

—*Col. R. I. Crone, MC, U. S. A.*

Surgical Technique, by *Stephen Power,* M. S., F. R. C. S., Senior Surgeon to the Dreadnought Hospital, Greenwich; Surgeon to the Royal London Homoeopathic Hospital; Surgeon to Eltham Hospital. 380 pages; illustrated. J. B. Lippincott Co., Philadelphia, Pa., publisher, 1951.

Designed for the young surgeon who knows more about "operations than about operating," this book deals with the "bricks and mortar of the surgeon's business and not with the architecture." It covers such

basic technics as positioning and fixing the patient on the table, locating and making the incision, clamping and tying bleeders, and the placing and running of various sutures. These fundamentals are not dismissed with platitudes and generalities, but are carefully explained and illustrated with good photographs and line drawings. The volume deals with the basic technical maneuvers that make up any and all surgical procedures and the "tactical" principles of planning such procedures rationally.

An apparent desire for comprehensiveness in scope has led to cursory treatment of some broad subjects, such as the surgery of malignancy. The treatment of some subjects is at variance with current American teaching. The style is British, with numerous eponyms, British spelling, and illustrations of apparatus or listing of formulas that are unfamiliar. This manual will fit handily in the side pocket of an intern's coat, but will not go readily in the attending surgeon's vest pocket. This perhaps indicates its scope and application. As a manual to assist the novitiate surgeon in learning the technics that lead to the acquisition of professional competence, this volume admirably fulfills its function.

—*Lt. Col. D. Lindsey, MC, U. S. A.*

The Pathology of Diabetes Mellitus, by *Shields Warren,* M. D., ScD., Departments of Pathology of the New England Deaconess Hospital and the Harvard Medical School, Boston, Mass.; Director of the Division of Biology and Medicine, U. S. Atomic Energy Commission; and *Philip M. LeCompte,* M. D., Departments of Pathology of the Faulkner Hospital and the Harvard Medical School, Boston, Mass. 3d edition, thoroughly revised. 336 pages; 112 illustrations; 3 colored plates. Lea & Febiger, Philadelphia, Pa., publishers, 1952. Price $7.50.

So many important advances have been made since 1938 in our knowledge of the pathologic conditions associated with diabetes that the appearance of this new edition of an outstanding treatise on the subject is most opportune. The style is admirably lucid and the numerous illustrations are of unusually high quality. Special attention is given to the intreased understanding of relationships between structural changes and functional alterations made possible by advanced technics in histology and histochemistry. The special pathology of the endocrine glands, blood vessels, kidney, and eye is well presented, as are the results of experimental diabetes and the pathologic changes seen in children. A shift in emphasis regarding vascular disease has resulted from the observation that the disabilities of diabetics of 1 or 2 decades standing are largely referable to disorders of the smaller vessels. The incidence of deaths from infection reported in the second edition was 38 percent, while in the cases added since 1938 it is only 6 percent, a tribute to the modern antibiotics. This book, with its wide coverage of the subject and comprehensive bibliographies, should be valuable to student, specialist, and general practitioner alike.

—*Capt. B. F. Avery, MC, U. S. N.*

Fundamentals of Psychiatry, by *Edward A. Strecker,* M. D., D. Sc., LL. D., Lit. D., F. A. C. P., Professor of Psychiatry and Chairman of the Department, Undergraduate and Graduate Schools of Medicine, University of Pennsylvania; Psychiatrist to the Pennsylvania, Philadelphia and Germantown Hospitals; Consultant and Chief-of-Service, Institute of the Pennsylvania Hospital; Consultant to the Surgeons General, U. S. Army and U. S. Navy, and formerly Consultant for the Secretary of War to the U. S. A. A. F.; Senior Consultant in Psychiatry, Veterans Administration; Consultant in Mental Hygiene, U. S. P. H. S.; Chairman, Committee on Psychiatry, National Research Council; Chairman, Committee on Psychiatry, American National Red Cross. 5th edition. 250 pages; 21 illustrations. J. B. Lippincott Co., Philadelphia, Pa., publisher, 1952. Price $4.50.

This book is dedicated to medical students, interns, and practitioners who wish to become complete physicians. The author states that instead of the present 5,000 psychiatrists in the United States there should be 20,000 to take care of the psychotics in mental institutions alone without taking into account the treatment of the 5 million psychoneurotics, the 2 million alcoholics, and the 3,500,000 mental defectives. "This edition is addressed particularly to general practitioners and workers in every area of medicine and surgery." There is a new chapter on psychotherapy and the chapter on psychosomatic medicine has been rewritten. It is pointed out that Socrates, 2,500 years ago chided Athenian physicians because they did not understand that the body would not get well without favorably influencing the mind. Dr. Strecker gives some informative case reports. The section entitled "Treatment Including Psychotherapy" gives an excellent review of treatments used and the indications for their use. He defines psychotherapy as "any honest treatment measure, emerging from the relationship between patient and doctor." He emphasizes the necessity of the doctor being interested in people and their problems. The chapter entitled "Psychiatry and War" is of particular interest to the military neuropsychiatrist.

—*Commander E. L. Hammond, MC, U. S. N. (Ret.)*

Clot Retraction, by *O. E. Budtz-Olsen,* M. D. (Cape Town), Wernher and Beit Laboratories, University of Cape Town. 149 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1951. Price $5.50.

This book presents an exhaustive review of the literature on clot retraction, in which the author shows how much confusion there is in this field. He then goes on to describe his own experimental work and correlates it with the generally accepted observations of others. A satisfactory explanation for previous disagreements was found in many instances. The subject matter is presented in a clear and systematic manner and the book makes delightful reading. The various external factors influencing clot retraction, the effect of the red and white blood cells, and the role of platelets, fibrinogen, and other plasma fractions are discussed. The underlying mechanism of retraction is explained and the physiologic function of clot retraction is discussed in its relation to clinical medicine. An interesting conclusion in the field of evolution was reached: that clot retraction serves no purpose

in human life. It is a vestigial function related to the primitive hemostatic mechanism carried down from some prehistoric ancestors of all mammals. This book is recommended to all professional people who are interested in blood coagulation and related subjects.

—*Lt. Col. T. A. Haedicke, MC, A. U. S.*

The 1951 Year Book of Physical Medicine and Rehabilitation (December 1950-January 1952), edited by *Frank H. Krusen,* M. D., Professor of Physical Medicine, Mayo Foundation; Head of the Section on Physical Medicine and Rehabilitation, Mayo Clinic. Associate Editors: *Earl G. Elkins,* M. D., Assistant Professor of Physical Medicine, Mayo Foundation; Consultant in Physical Medicine and Rehabilitation, Mayo Clinic; and *George G. Deaver,* M. D., Professor of Clinical Rehabilitation and Physical Medicine, New York University College of Medicine; Director of the Department of Physical Medicine and Rehabilitation, Bellevue Hospital. 382 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., 1952. Price $5.50.

The principles of medical editing and publishing which apply to the "Year Book" series are known to the medical and ancillary professions. These principles are well employed in this current edition which covers the time span from December 1950 to January 1952. The editors have enlarged the scope of the work by including several special articles and subjects, such as (1) spina bifida; (2) diagnostic applications of physical agents and procedures, including sonography and ultrasonoscopy; (3) rehabilitation technics in various types of physical and mental disabilities, including geriatrics; and (4) teaching accomplishments and needs. The changing needs in medicine as a social science are emphasized. The book contains abstracts of articles from selected journals and publications during the period covered. The editorial comments interspread throughout the book enhance its value.

A review of the abstracted articles indicates the wide range of experience and interest of the present editors. Abstracts of articles on the broad field of rehabilitation reflect the continued concern and progress of a new discipline in the relief of the devastating consequence of chronic illness and serious disability. The degree to which communities and industries have accepted responsibility for these problems is indicated in several abstracts and editorial statements. The index is excellent, affording ready reference to various types of physical disabilities and technics used in their management, including rehabilitation. An author index is included. This handbook is a ready source of information on current thought and topics in its field and, as such, is highly recommended to all practitioners of medicine.

—*Lt. Col. J. H. Kuitert, MC, U. S. A.*

Orthodontics, Diagnosis, Prognosis, Treatment, by *Bercu Fischer,* D. D. S. 334 pages; 1,180 illustrations on 212 figures. W. B. Saunders Co., Philadelphia, Pa., publisher, 1952.

This book presents a clinical analysis of results obtained by the author in treating various orthodontic conditions with emphasis being

placed on the use of occipital or extraoral anchorage and what he terms "sectional treatment." The book includes specific methods of diagnosis, prognosis, and treatment used by the author in his practical research. The book is well illustrated with drawings, charts, and photographs. The chapter dealing with specific cases demonstrates the types of malocclusion in various stages of treatment. A detailed account of the construction of the "headcap" auxiliaries and archwires used in conjunction with occipital anchorage is presented.

This book is intended for use by the orthodontist rather than by the general dentist. Although it is of particular interest to the orthodontist utilizing the "edgewise" appliance, the principles involved can be applied to any device. The manner and sequence in which the material is presented and the accompanying complete bibliography are noteworthy.—*Capt. T. D. Pryse, U. S. A. F. (DC)*

The Human Blood Groups, Utilized in Disputed Paternity Cases and Criminal Proceedings, by *P. H. Andresen,* Chief, Municipal Blood Bank, Bispebjerg Hospital; Formerly Chief, Serological Department, University Institute of Legal Medicine, Copenhagen, Denmark. 115 pages. Charles C Thomas, Publisher, Springfield, Ill., 1952. Price $3.75.

This compact discussion of certain medicolegal applications of human blood group determinations is intended for use by physicians, lawyers, and others who might be interested but have not specialized in this field. In pleasant, readable style the author starts with a general description of the properties of the blood groups, by systems: A-B-O, M-N, P, and Rh. He then proceeds to more complex variations within systems and, finally, outlines and tabulates the paternity and nonpaternity possibilities and exclusions. The book is not a description of technics, though certain general technical limitations are fully explained. Rather, it presents the more fundamental problems of probability and evidence and methods of cross checking by means of blood group determinations. The "criminal proceedings" cited in the title deal chiefly with the determination of blood, semen, and saliva stains. In Denmark, all medicolegal tests are performed at the University Institute of Legal Medicine, an institution economically as well as administratively independent of law courts and the police. The availability of this remarkable facility is perhaps the reason why blood group determinations are used to settle many disputed paternity cases (about 2,000 per year). This book will be a valuable reference to the nonspecialist confronted with a problem in this limited field.

—*Lt. Col. R. L. Cavenaugh, MC, U. S. A.*

Dynamic Psychiatry, Transvestism—Desire for Crippled Women, Volume 2, by *Louis S. London,* M. D. 129 pages; illustrated. Corinthian Publications, Inc., New York, N. Y., publisher, 1952. Price $2.50.

This book presents an interesting case of transvestism, or the impulse to adopt the dress and ways of the opposite sex without any necessary change in the direction of the sexual impulses. The book opens with a

brief historical discussion of transvestism with particular emphasis on the Greek culture and Nero's marriage to a eunuch, who the author described as the earliest known transvestite. The second chapter contains 50 psychobiographic phantasies illustrated and described by a patient. The third chapter gives a brief case history of the patient and analysis of the case material, which is primarily descriptive and does not fully explain the psychodynamics involved. In addition to the patient's interest in crippled women, there was also a large element of fetishism manifested by an interest in high, mannish shoes worn by his female phantasy figures.

—*Commander C. H. Bagenstose, MC, U. S. A.*

Principles of Refraction, by *Sylvester Judd Beach,* A. B., M. D., F. A. C. S., Consultant, Staff Maine Eye and Ear Infirmary; Chief Ophthalmologist, Portland City Hospital; Member of Staff, Maine General Hospital; Past President, Portland Medical Association and New England Ophthalmological Society; Council, National Society Prevention of Blindness; Co-Founder, Ophthalmological Study Council; Member of Council, Academy Ophthalmology and Oto-Laryngology; Chairman, Section of Ophthalmology; A. M. A.: Past President, American Ophthalmological Society; Past Secretary and Emeritus Member, American Board of Ophthalmology. 158 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., publisher, 1952. Price $4.

This excellent book on refraction is written in simple language. The author does not confuse the reader with a lot of high-sounding optical and ophthalmologic terms. There are 8 chapters covering the subjects from practical optics to ocular neuroses. The first chapter deals with the subject of optics in general. The longest chapter is the one on the routine of subjective refraction in which the various methods of refraction, their advantages and disadvantages, are discussed. In the last chapter the ocular neuroses are described under such subheadings as confusion symptoms, diagnosis by exclusion, functional overlay, genesis of functional disorders, the subconsciousness, and the eye in neuroses. This book is recommended for all ophthalmologists who are doing refractions. This book will be of great help to the medical student or intern in simplifying his conception of refraction.—*Col. S. L. Cooke, MC, U. S. A.*

Clinical Methods, A Guide to the Practical Study of Medicine, by Sir *Robert Hutchinson,* Bart., M. D., LL. D., F. R. C. P., Consulting Physician to the London Hospital and to the Hospital for Sick Children, Great Ormond St., and *Donald Hunter,* M. D., F. R. C. P., Physician to the London Hospital. Revised with the assistance of *R. R. Bomford,* D. M., F. R. C. P., Physician to the London Hospital. 12th edition. 484 pages; illustrated. J. B. Lippinoctt Co., Philadelphia, Pa., publisher, 1951.

This book attempts to present in one small volume approved methods of history taking, physical diagnosis, laboratory methods, and salient points of anatomy, physiology, and clinical medicine.

It is divided into chapters on history and general observations, detailed discussions of each system (circulatory, nervous, alimentary, et

cetera), examination of children, pathologic fluids, and bacteriology. All clinical and laboratory data relevant to the topic are lumped together in one chapter. As an example of the whole, the chapter on the circulatory system includes a discussion of its anatomy, surface anatomy and its pathologic alterations, venous pressure, congenital anomalies of the heart and arteries, palpation, percussion, murmurs, blood pressure, the technic and interpretation of polygraphs, sphygmograms, electrocardiograms, fluoroscopy, and orthodiagraphy, alterations in heart rhythm, and circulation time.

The authors have attempted to compress the material of 6 or 8 large textbooks into one small volume. As a result, there is not enough information on any one subject to enable the reader properly to understand or apply the procedures; and even for purposes of review, better books are available. For this reason this book is not recommended.

—Lt. Col. C. Gronbeck, Jr., MC, U. S. A.

Office Endocrinology, by *Robert B. Greenblatt,* B. A., M. D., C. M., Professor of Endocrinology, Medical College of Georgia; Chief of Endocrinology, University Hospital; Director of Endocrine Clinic, University Hospital; Consultant to the Surgeon General, U. S. Army; Consultant to Lenwood Hospital, U. S. Veterans Facility; Special Consultant, United States Public Health Service; Diplomate of American Board of Obstetrics and Gynecology. With a Foreword by *G. Lombard Kelly,* M. D., President, Medical College of Georgia. 4th edition. 561 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1952. Price $10.50.

The new edition of this text is much larger than the first. The author has divided the subject into a general consideration of pituitary, thyroid, and adrenal disturbances, followed by specific consideration of female and male endocrinology, with 38 pages devoted to hormonology and a section on diagnostic procedures. Although the chapter on hyperthyroidism is well written as far as it goes, the author does not discuss the many conditions simulating hyperthyroidism which may present diagnostic pitfalls. The upper limit of 400 mg. of propylthiouracil which he recommends is inadequate in many cases of hyperthyroidism. Radioactive iodine and other antithyroid compounds are not discussed. The author discusses the uses and contraindications of ACTH and cortisone in detail. The vaginal smear technic and its interpretation is well described and is illustrated with color plates.

In the previous editions the author devoted a portion in the back of the text to recommended therapeutic products, their proprietary names, and dosages. In the new edition these are listed in the separate chapters. The former method may be the better. Despite the title of this book, the material is suitable for ward reference. The index is adequate and the text can be recommended to students and practitioners as well as internists and specialists in endocrinology.

—Col. F. W. Pruitt, MC, U. S. A.

Bone Tumors, by *Louis Lichtenstein,* M. D., Senior Pathologist, General Medical and Surgical Hospital, Veterans Administration Center, Los Angeles; Formerly Associate Pathologist, Hospital for Joint Diseases, New York; Consultant in Bone Tumors, Tumor Registry of the California Medical Association Cancer Commission; Sometime Lecturer in Bone Pathology, Medical Extension, University of California at Los Angeles. 315 pages; 155 illustrations. The C. V. Mosby Co., St. Louis, Mo., publisher, 1952, Price 10.50.

This reference book on bone tumors will be invaluable particularly to pathologists and orthopedic surgeons. The excellent organization and clarity of this work reflects a long study and experience in bone pathology by the author.

The material is divided into 22 chapters and an appendix of some of the non-neoplastic lesions of bone which may be mistaken for tumors. The subject matter is presented in a concise and readily understandable manner and is amply illustrated. In addition to the presentation of the clinical features and pathology of the various bone tumors, there is an excellent discussion on treatment and prognosis.

It is difficult at times to separate lesions that should be placed in the category of neoplasia from lesions that are not considered to be tumors. Because of this, the appendix on some of the non-neoplastic lesions of bone likely to be mistaken for tumors would be more useful if expanded. Such lesions as aneurysmal bone cyst need more than the few lines devoted to them. On the whole, however, this book is highly recommended to anyone interested in lesions of bone.

—*Commander V. E. Martens, MC, U. S. N.*

Handbook of Cardiology for Nurses, The Disease, the Patient, Modern Concepts of Treatment, by *Walter Modell,* M. D., F. A. C. P., Assistant Professor, Comell University Medical College; Associate Cardiologist, Beth Israel Hospital and Hospital for Joint Diseases. Foreword by *Edna L. Fritz,* R. N., Assistant Professor of Medical Nursing, Comell University, New York Hospital School of Nursing. 246 pages; illustrated. Springer Publishing Co., Inc., New York, N. Y., publisher, 1952. Price $3.50.

In the introduction, the author states quite clearly the purpose of this book: "This is not a simplified or abridged physician's textbook on heart disease. In organization and approach it is designed for the nurse who takes care of the cardiac patient. The technical information is limited to what the nurse needs to know about heart disease, the mechanics involved in the production of symptoms, the course of the disease, and the problems of treatment." It is of value not only to those just entering the profession of nursing, but will prove of great benefit to those in need of a refresher course in cardiac nursing. Chapter 22, on drugs, is particularly good. The material is presented in a most interesting style and is easy to follow.

—*Commander M. Terrill, NC, U. S. N.*

Surgical Forum, Proceedings of the Forum Sessions, Thirty-Seventh Clinical Congress of the American College of Surgeons, San Francisco, Calif., November 1951. Surgical Forum Committee: *Owen H. Wangensteen,* M. D., F. A. C. S., Minneapolis, Chairman; *Warren H. Cole,* M. D., F. A. C. S., Chicago; *Robert E. Gross,* M. D., F. A. C. S., Boston; *Michael L. Mason,* M. D., F. A. C. S., Chicago; *Carl A. Moyer,* M. D., F. A. C. S., Dallas; *I. S. Ravdin,* M. D., F. A. C. S., Philadelphia. 667 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1952.

This volume is a compilation of 125 articles and is a real contribution to the field of surgery because the reports are recent and bring into focus the rapid pace and wide spectrum of modern experimental surgery. Moreover, most of these reports are a year or more in advance of routine journal publications. For the convenience of the reader, the articles are systematically grouped into the following sections: (1) the lungs and esophagus, (2) the stomach and spleen, (3) the intestines, (4) the liver and portal system, (5) the heart, (6) blood vascular system and blood flow, (7) the urogenital tract, (8) neurophysiology and neurosurgery, (9) orthopedics, (10) repair and regeneration, (11) the endocrines, (12) body fluids and electrolytes, and (13) blood volume and shock.

The reports are well organized and brief, with an average length of from 3 to 6 pages, including concise paragraphs on discussion, summary, and bibliography. A few abstracts of pertinent articles appear at the end of some of the sections. Many of the articles are illustrated with photographs and others include diagrams or statistical charts. The index is comprehensive and the contributors are identified by institution and affiliation. The book is attractively arranged and is very readable. To those interested in experimental surgery, it will be an excellent quick reference of the current status of a multitude of experimental surgical problems. It is highly recommended for surgical residents, surgeons, and physicians interested in related surgical problems.—*Lt. Col. R. A. Lawn, U. S. A. F. (MC)*

Vascular Diseases in Clinical Practice, by *Irving Sherwood Wright,* M. D., Professor of Clinical Medicine, Cornell University Medical College; Attending Physician, The New York Hospital. 2d edition. 552 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., 1952. Price $8.50.

Peripheral vascular diseases are becoming recognized for the important role they are assuming in all branches of medical practice. The author of this book presents a direct, clear, concise, and inclusive discussion of the subject. His classification of disease conforms with that of the recent revision of the Committee on Nomenclature and Diagnoses for Peripheral Vascular Disease. There is an excellent discussion of history taking and a step-by-step method of examination with an explanation of what to look for and an interpretation of findings.

Special examinations and complex tests are included, but the author stresses the simple tests because a diagnosis can usually be made with equipment that is standard in a doctor's office.

In describing the major vascular diseases, the author makes use of his personal experience and illustrates with pictures and case histories. One chapter is devoted to the neurovascular syndrome of the shoulder girdle in the study of which the author has been a pioneer.

Although this new edition brings up to date our knowledge concerning atherosclerosis, shoulder girdle syndrome, cryoglobulinemia and cold agglutinins, and the latest views on anticoagulant therapy, the first edition is still an excellent manual and for physicians having a copy it is questionable whether there is enough change to justify buying this second edition. This is an excellent book for students, general practitioners, or those interested especially in diseases affecting the peripheral vascular system.—*Col. D. O. Lynn, MC, U. S. A.*

Orthopaedic Appliances Atlas. Volume I: Braces, Splints, Shoe Alterations. A Consideration of Aids Employed in the Practice of Orthopaedic Surgery. Published under the Auspices of The *American Academy of Orthopaedic Surgeons, Inc.*, in Co-operation with *Office of the Surgeon General, U. S. Army*, and the *Veterans Administration*, Department of Medicine and Surgery. 588 pages; illustrated. J. W. Edwards, Ann Arbor, Mich., publisher, 1952. Price $10.

Brace and prosthetic making has for generations been a father-son or journeyman-apprentice trade. In no one place has there previously been assembled usable information of proved value for a free exchange of information and ideas between doctor and brace maker. This volume, and the succeeding ones, should fill this gap. It is evident from the immense amount of information collated in this work that the attempt thus far has been successful beyond expectations. The book is divided into sections on (1) a historical review of braces and splints, (2) materials and their use, (3) appliances for the spine and trunk, (4) appliances for the upper extremity, (5) appliances for the lower extremity, (6) paralytic braces, and (7) measurements.

The section on materials contains technical information of such value as to constitute a basic textbook and reference work for the orthopedist and brace maker. A meeting ground on classification and use of materials can be had by use of this section as the standard. A historical approach prefaces the anatomic and physiologic review of each region because it is only with a clear understanding of these that braces can be made workable and useful. The more widely used appliances are described in detail. The volume will have served admirably if it does no more than crystallize the nomenclature of orthopedic appliances and free

it from the confusion that has resulted from innumerable minor variations in basic designs. Details of construction and application are so well documented and illustrated that the beginner can rely on these sections with confidence. The chapter on shoe alterations deserves special mention because of its usability in the less specialized branches of medicine. The section on measurements uses accepted standards, and these can now be used authoritatively in medicolegal work.

To give credit by name to the many people who have created this work and brought it into useful form would be impossible in this review. The author index alone contains over 400 names. Much of the detail of assembly was performed at the Walter Reed Army Medical Center, Washington, D. C.

—*Commander C. R. Carr, MC, U. S. N.*

Reaction to Injury, Pathology for Students of Disease. Volume II: The Reactions of Submission and Adaptation and the Disease Entities Arising out of Their Elaboration, by *Wiley D. Forbus,* M. D., Professor of Pathology, Duke University; Pathologist to the Duke Hospital. 1,110 pages; 836 illustrations, 54 in color. The Williams & Wilkins Co., Baltimore, Md., publisher, 1952. Price $20.

After presenting an introduction to the study of disease and the body's active resistance to injury, this second volume further elaborates the author's dynamic approach to disease in the concepts of response to injury by (1) passive submission, (2) offering active resistance, and (3) effecting an adaptation to the changed conditions and circumstances arising in the course of injury. This volume starts with part 3 which presents the submissive reaction and the metabolic disturbances arising from disease. These include chemical depositions, poisonings, circulatory distrubances, nutritional deficiencies, metabolic disturbances as seen in organs and groups of organs, and disturbances related to growth and development (as in congenital malformations from disturbances of the prenatal period and as in neoplasia from disturbances of the postnatal period. Part 4 presents reaction to injury of the various anatomic systems through adaptation that may be functional or structural. Here is dynamic, integrated pathology with sufficient basic clinical material to allow logical correlation between clinical signs and symptoms and the natural course of disease processes as built on the solid rock of pathologic anatomy, functionally interpreted.

That only about 5 percent of the volume concerns cancer may disturb some readers, particularly those who interpret Virchow's expression "cellular pathology" as indicating that evidence of body injury would be found solely in cells. Furthermore, the view "that all injury must be referred ultimately to cells or groups of cells" may alienate those readers who are caught in some of

today's currents of fads and fancies which occasionally seem to imply that the best method of distinguishing between an automobile factory and a bulldozer factory is to destroy both and analyze the content of the remains. To this unusual type of presentation the older students of disease will react with an aroused mind, just as the author desires; the new students will appreciate the lucidity, the impression that the material continuously concerns the patient and that this is knowledge he will need on the ward, in the dispensary, or in a research laboratory.

—Brig. Gen. E. DeCoursey, MC, U. S. A.

Handwriting, A Personality Projection, by *Frank Victor,* Ph. D., American Lecture Series, Publication Number 96, A Monograph in American Lectures in Psychology. 149 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1952. Price $3.75.

In this volume the author has attempted to present to the reader a "fully dynamic approach to handwriting analysis." He discusses the subject under 2 general headings: (1) basic graphology, which supplies handwriting data, and (2) applied graphology, which in the opinion of the author interprets this data psychologically. The introduction and first chapter give the reader the impression that the author is on the defensive with regard to the subject of graphology and is concerned with justifying its existence "as a major tool for delving into the personality." In the section on basic graphology, he attempts to formalize the architecture of the written letter and word and has postulated 3 dimensions: deep rhythm, movement from left to right, and movement that is upward and downward.

The author frequently refers to more or less standard works in psychiatry and psychology. The quotations which he uses to try to prove his hypotheses, are, for the most part, taken out of context and would not in the original writing substantiate his formulations. The section on applied graphology touches on many facets of personality but only in a most superficial fashion and shows no deep appreciation or understanding of the more basic and fundamental principles of the psychodynamics of human behavior and adjustment, despite many claims of the author to the contrary. The 2 essentials of any useable technic—validity and reliability—are rather casually dismissed by the author despite his protestations that graphology is a science. I would not venture to state whether or not there is "something to this business of handwriting" but I do not believe that this volume will contribute much to the literature in the area of personality.

—Col. C. S. Gersoni, MSC, U. S. A.

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